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Contents:

	PAGE
Reflections on the Commissioners' Report	161
Electrical Progress in the United States	162
Expert Witnesses	162
Modern Electrical Measuring Instruments, by C. L. Lipman (*illus.*)	163
Electricity Supply Tariffs, by Professor W. Cramp (*concluded*)	165
Tests for Resultant Economy	167
Unemployment during 1926 (*illus.*)	168
Legal	169
Correspondence—	
Wattmeter Calculations	169
Power Supply for Wireless Sets	170
River Water—or Cooling Towers?	170
Electrical Activity at Trafford Park (*illus.*)	171
Business and Industrial Notes	172
Lighting and Power Notes	177
Tramway and Railway Notes	179
Telegraph and Telephone Notes	179
Radio Notes	180
Contract Information	180
Forthcoming Events	182
Notes	182
Institution Notes	185
Our Personal Column	185
Financial Section—	
New Companies Registered	186
Official Returns of Electrical Companies	186
City Notes	187
Stocks and Shares	187
High-Voltage "S.L."-Type Cables, by P. Dunsheath (*illus.*) (*concluded*)	189
A Large Cable Armouring Machine (*illus.*)	190
The Physical Society's Exhibition (*concluded*)	191
Electrical Notes from Canada	192
New Electrical Devices, Fittings and Plant (*illus.*)	193
Industrial Electric Heating	194
Domestic Refrigeration	195
The Telephone Service	196
Electric Floodlighting	197
Reviews	198
Published Specifications	199
Trade-Mark Applications	199
New Work for Contractors	200

Reflections on the Commissioners' Report.

THE Electricity Commissioners' Annual Report, besides satisfying mild curiosity as to the progress of the industry and providing an additional volume for the office library, may fittingly serve as a stimulus to fruitful thought. The mind of the Commissioners is more or less reflected therein, and a sagacious eye roving over the pages should be able to gather more than one point to turn to account.

Provincial electricity supply companies, for instance, may profitably ruminate on the question of extension of tenure touched upon in the Report. The Commissioners point out that many of the early Provisional Orders will expire in the course of the next few years, or be purchasable by a local authority at some early date. The London Companies have, of course, set their house in order and secured a very satisfactory long lease. It now remains for the provincial companies to follow suit, and similarly stabilise their position. And this would apply not merely to companies which have Orders on the brink of expiry, but also to any others which are within measurable distance of an option, since a party *in extremis* is not always in the best position to bargain. Extension of tenure will be, as is pointed out in the Report, a bargain mainly on the basis of a sliding scale of price and dividend. A company operating under the scale would, of course, exchange speculative possibilities for stability, and have to rely for increased dividends mainly on the extension and development of business. Under the old régime, there was, in many cases, a strictly limited outlook in this direction; but with the possibility of cheap bulk supply under the schemes of the existing Acts and the new Electricity Act, there is a very favourable prospect for many companies to expand, since they will be able to devote their whole available capital to immediately remunerative distribution, instead of having to provide plant which is always in advance of demand. Moreover, the fact, as shown in the present and previous Reports, that the Commissioners favour extensions of supply areas into surrounding districts, has an impor-

tant bearing on the future of many provincial companies. A perusal of the notes in the Report on the Special Orders granted should wake up all companies to consider their position, as there is a very energetic roping-in of unappropriated areas going on. This is shown in the Report by the figures given for the Electricity Districts. In eight districts alone, since 1920 powers have been granted for distributing areas for over 2,000 square miles. The unoccupied areas were shown in the series of maps which we published last year for the express purpose of assisting those who contemplated development of this kind.

Non-statutory undertakings should see a red light in the Commissioners' remarks under the heading "General Observations." Referring to the numerous cases in which public supplies of electricity in villages and small towns are being given by undertakings without statutory powers, the Commissioners gently intimate that such non-statutory undertakings may be ignored, where circumstances require it, and statutory powers may be given to some other undertaker over their area of supply. It might be politic, therefore, for non-statutory authorities to take the warning to heart and regularise their position by applying for Special Orders. It will be remembered that some years ago the Commissioners tried to induce them to do so by simplifying the procedure and cheapening the cost of obtaining the Order.

Undertakers who have not made up their minds on the question of subscribing to the Electrical Development Association may set their minds at rest over the scale of contributions by a perusal of the Commissioners' approving comments.

A glance at the proceedings reported with regard to the Trade Facilities Acts, where it will be seen that only nine applications were made for loans, shows that either the small companies were lethargic in enterprise or else capital was freely forthcoming in the usual way. In the case of Unemployment Grants, the requirements have been tightened up; it must be shown that the need is exceptional, and that the work would not be put in hand in the ordinary course for a considerable period. Consequently the applications for grants for electricity schemes have practically ceased.

Undertakers interested in "fringe" supply will be glad to have the elucidation given in a special case quoted by the Commissioners, where it was ruled that for premises partly in and partly outside the statutory area, supply means "delivery at the consumers' terminals," so that if these are inside the area, the undertaker can ignore the fact of part of the premises being outside that area. This case was reported in our columns a year ago.

An interesting section headed "Mutual Assistance: Bulk Supplies" gives an analysis of the growing number of bulk supplies taken and arranged for, and the figures displayed ought to supply their quota of persuasion to those conservative undertakers who still hold pathetically to the ideal of a self-contained undertaking, irrespective of advantageous outside help.

Electrical Progress in the United States.

THE feast of statistics which is annually provided for its readers by the *Electrical World* is always interesting to electrical men on this side of the water, if for no other reason than that it arouses their envious admiration. From the electrical point of view the United States is particularly fortunate in that it is abundantly provided with coal and water-power, that the gas industry never secured the lead which it possesses in European countries, and that the Legislature has not laid its paralysing hand on electricity supply, so that electrical undertakings have been free to till a fertile field untrammelled by the barbed wire of statutory restrictions and limitations of area. That progress should be rapid under such favourable conditions was inevitable; but that comparisons should be instituted between it and the state of electrical affairs in this country, where the conditions are fundamentally different, was very unfair, without the added injustice of using false premises. However, we are confidently assured that when the Central Electricity Board gets to work we shall soon make up for lost time.

What we have to aim at is indicated by our contemporary's jubilant head-line: "A $20,000,000,000 Industry." We read that the total capital invested in the various branches of the electrical industries in the United States is now 19,500 million dollars—say 3,900 million pounds—that the annual gross revenue is about 1,187 millions, and that the new capital annually invested is 314 millions sterling. These are colossal figures, and indeed represent "an industrial development of unparalleled magnitude in commercial history." Electricity supply accounts for an annual gross revenue of 337 millions sterling; the energy generated amounted to 68,732,000,000 kWh last year. The telephone service deals with 70 million calls daily. Electric railways (including tramways) carried 14,400 million passengers on 40,000 miles of track. Manufacturers of electrical equipment employ 400,000 persons, and do a gross annual business estimated at about 475 millions sterling.

The energy sold to consumers for lighting, power, &c., in 1926 was estimated at 55,468 million kWh, or 470 kWh a head. This is still somewhat short of the 500 kWh which was freely but erroneously quoted as attained in 1924. About one-third of it was generated by water-power. Over 68 million people—58 per cent. of the population—are living in electrically lighted dwellings.

Expert Witnesses.

IN a case which is now proceeding in the Chancery Division, Mr. Justice Tomlin has made some observations relating to expert evidence which are of interest to those who employ, as well as to those who are called upon to act as, expert witnesses. The action before the learned judge involves an inquiry into the flooding of certain mines in South Wales. The case bristles with technical and scientific questions which the parties, naturally enough, desire to have properly explained to the Court, but having regard to the length of the suit (it has already been before the Court for about six weeks), the learned judge expresses the opinion that he must limit the number of expert witnesses to be called on either side. He pointed out that if suitors were always to be entitled to call an unlimited number of experts, two evil consequences would follow. In the first place, the hearing of a cause would be unduly prolonged—to the prejudice of other litigants who were waiting to be heard; and in the second place, it would load the dice in favour of the wealthy litigant who could call the greatest number of experts. He has, therefore, made a rule for himself to the effect that, except in special circumstances, two expert witnesses only will be allowed. This will not, of course, prevent any witness to fact being called. The distinction between an expert witness and a mere witness to fact may occasionally be somewhat hard to draw; but generally speaking an expert witness may be said to be one who merely expresses a scientific or other opinion on a given set of facts or circumstances. There is probably no kind of dispute in which the technical witness is of greater importance than that in which electrical questions come up for discussion. Even the phraseology of the profession is baffling to the mere lawyer; and the duties of the expert begin long before a case comes on for hearing in Court. When a technical dispute arises, solicitor and counsel have each to be taught enough "electricity" to enable them to advise their client, and if litigation ensues it may be that the judge will have to be taught the elements of the subject. But it is manifest from what has taken place before Mr. Justice Tomlin that one learned judge at any rate does not want to have his Court overcrowded with scientific witnesses.

Modern Electrical Measuring Instruments.

A Review of Recent Developments and Improvements in connection with Electrical Indicating and Recording Instruments, and Protective Relays.

By C. L. LIPMAN.

AMONGST the articles that appear in the technical Press, the subject of electrical instruments appears to have been somewhat neglected. The development of this branch of electrical engineering has been very marked in the last few years, and in no part of it have greater improvements been made than in connection with protective relays.

Indicating Instruments.

In the case of indicating instruments, little alteration in the active principles has taken place. The permanent-magnet moving-coil instrument is used for direct current, the moving-iron type for a.c. and d.c., the dynamometer type for a.c. and d.c., the induction type, and the electrostatic, hot-wire, and thermal types for a.c., the two last named being particularly suitable for high-frequency circuits.

Dealing first with moving-coil ammeters of the shunted type, important points have been the standardisation of the voltage drop (75 millivolts) and the drilling of the shunt ends. The length of scale has been considerably increased in these instruments as made by all the leading makers, and some years ago the Record Co. introduced an instrument designated as "Cirscale," in which the angular deflection was practically the same as in induction instruments, namely, about 270 deg. of arc.

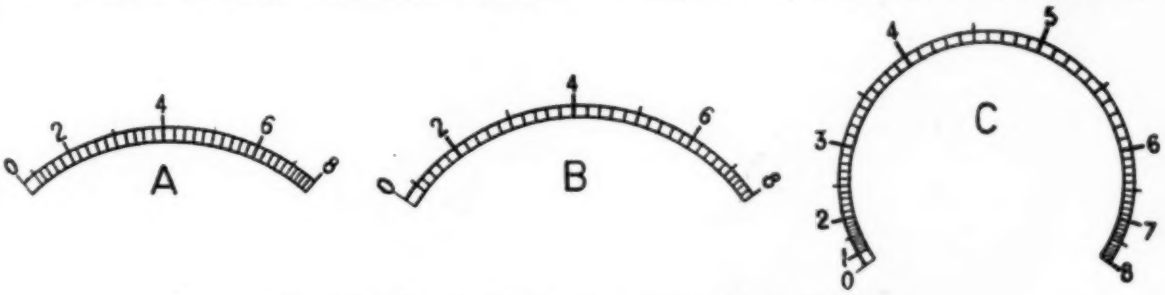
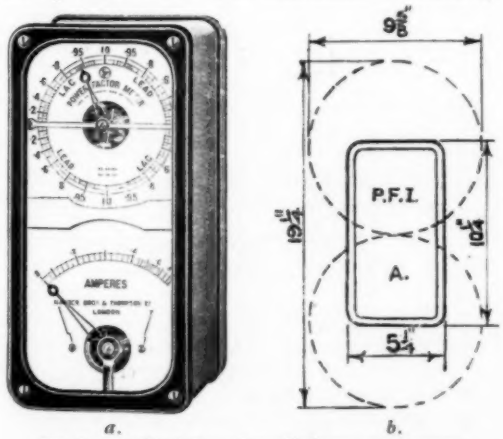


Fig. 1.—Three Stages of Development of Moving-iron Instruments, 8-in. Dial Size.

In the case of moving-iron instruments, which are very largely used on account of their robust and simple construction, and are the type most largely employed on a.c. switchboards, many important improvements have been introduced. The scale-length of these instruments has been materially increased, so that the length of scale is equivalent to the diameter of the dial. "Long-scale" moving-iron instruments have been developed by Messrs. Record, Martin & Furderer, Nalder Bros., and others; in the case of the Record instrument, the "floating iron" principle is employed. A further development of the "long-scale" moving-iron instrument has been made by Messrs. Nalder Bros., & Thompson, Ltd., which differs from the above-described designs, in that it employs two sets of iron; it is suitably damped, and owing to its simple construction is not liable to oscillate on fluctuating loads.

In the Martin & Furderer type, the angular deflection is about 220 degrees. In this type the damping is electromagnetic, and the instrument is reasonably deadbeat. This instrument employs the scroll-type repulsion iron, but in that it gives a larger angular deflection it is a successful development of the type originated many years ago by Nalder Bros. & Co., Evershed and Vignoles, Hartmann & Braun, and more recently by the Weston Co.



a. *b.*

Fig. 2.—Combined Power-factor Indicator and Ammeter.

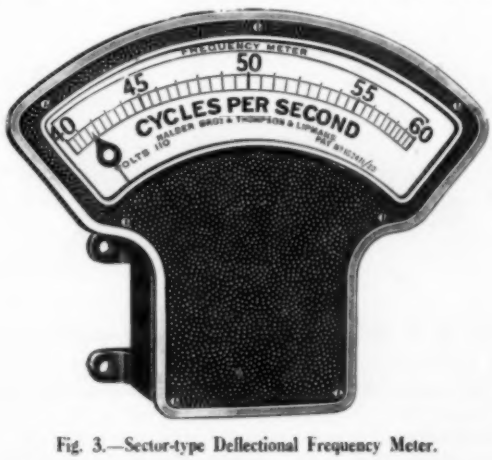


Fig. 3.—Sector-type Deflectional Frequency Meter.

Fig. 1 illustrates the three stages of development of the moving-iron instruments of the 8-in. dial size; for convenience of comparison, one size of instrument is shown: (A) shows the original scale length of about 6 inches, (B) the "Hyper-scale" or "Super-scale," as these are called, in contradistinction to the shorter scales, and (C) the long-scale type.

Apart from the improvements introduced in the instruments themselves, a new style of case has been pro-

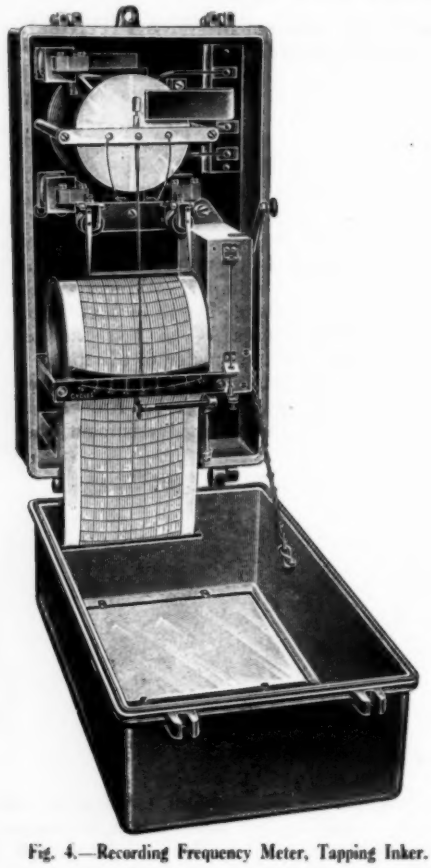


Fig. 4.—Recording Frequency Meter, Tapping Inker.

duced. This is square or rectangular in form, and in many cases leads to great economy in switchboard space. Fig. 2*a* shows the general arrangement of a power factor indicator and ammeter combined. Fig. 2*b* illustrates the space that would have been occupied had two round instruments been employed. This design is particularly suitable for use in the control rooms of large electricity

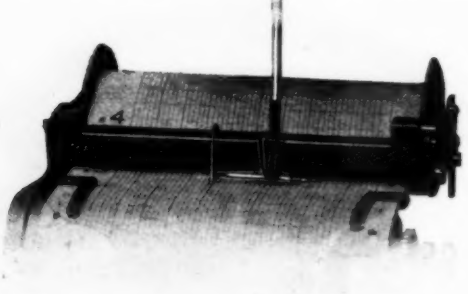


Fig. 6.—Method of Obtaining Rectangular Co-ordinates.

supply undertakings, where space is an important factor.

In the case of 3-phase systems, it is often convenient to fit three ammeters in one rectangular case. A complete line of such instruments has been developed by Nalder Bros. & Thompson Ltd., and by the Weston Electrical Instrument Co.

Single instruments or combination instruments are made in rectangular cases. There has been considerable demand for the following combinations:—

Power-factor meter and ammeter,
Wattmeter and ammeter,
Wattmeter and voltmeter.

Besides ammeters, voltmeters and wattmeters, new types of power-factor meters, frequency meters, and synchroscopes have been devised. Originally frequency meters were mainly of the resonance or vibrating-reed type; now deflectional frequency meters are generally employed. They possess the advantage that they are easier to read from a distance, and the disadvantage of the actual frequency to be measured lying between two reeds, thus reducing the amplitude, is avoided.

Fig. 3 illustrates a sector-type deflectional frequency meter.

Recording Instruments.

Considerable developments have also taken place in chart recording or "graphic" instruments.

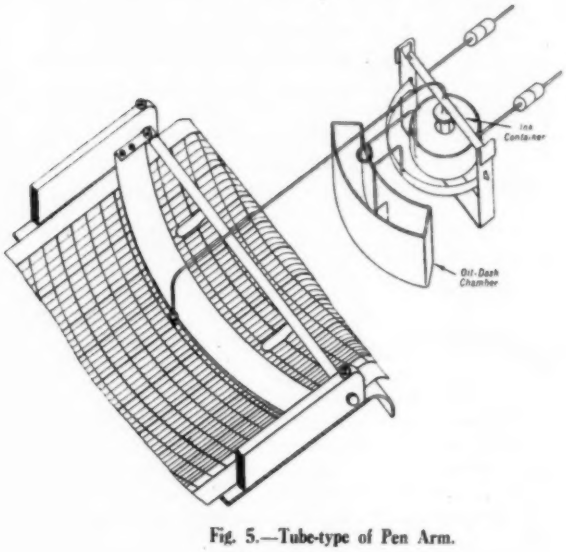


Fig. 5.—Tube-type of Pen Arm.

In addition to recording ammeters, voltmeters, and wattmeters, the details of which are well known, power-factor indicators and frequency meters have been introduced. Combination instruments are also obtainable for such purposes as feeder logs, &c., multiple pen

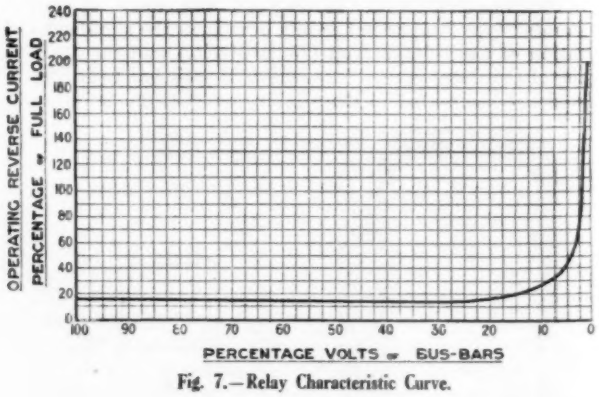


Fig. 7.—Relay Characteristic Curve.

recorders for telephone work, and revolution recorders or speed indicators, which generally consist of a magneto generator and a recording voltmeter.

Recorders have been specially adapted for fitting to electric trains, and a special system of cradle mounting has been devised which protects the instruments from the effects of excessive vibration. These recorders give valuable information, and tend to promote the efficient and economical running of the trains.

With regard to the method of marking the chart, the original method was to fix a pen at the end of the pointer

arm. The disadvantage of this method lies in the fact that errors due to the variation of the amount of ink in the pen can never be wholly eliminated. Various methods of getting over this difficulty have been adopted by different makers, amongst which the following serve as examples:—

A tapping mechanism by which the chart is inked at regular intervals. The inking device consists of a short length of fine tube fixed to the end of the pen arm, one end of which moves in a trough, at the back of which is an inking pad; the other end taps on the chart at regular intervals, generally ¼ or ½ minute, and is depressed on to it by a bar actuated by an electromagnet, thus (simultaneously) causing the ink to flow in the tube from the pad and making a dot on the chart. If the time intervals are sufficiently short, the record differs little from a continuous line.

The advantage of this method of inking is that the pen is not continuously in contact with the chart, and thus "pen to paper friction" is eliminated. This ensures accuracy, and is particularly valuable in the case of instruments wherein the forces are necessarily small, as in recording frequency meters and power-factor indicators. Fig. 4 illustrates a recording frequency meter embodying these features.

Another type of recording instrument which also gets over the error due to variation of ink in the pen was originally introduced by the Esterline Company of Indianapolis, and has since been further developed in this country by Messrs. Everett, Edgcumbe & Co., Limited, and others. In this type the pen arm consists of a fine tube which is normally full of ink, one end moving in a vessel containing the ink and the other end over the chart; the error due to variation of the amount of ink is thus eliminated. Fig. 5 illustrates the general arrangement of such a recorder.

With regard to charts, there has been little alteration in these in the last few years. Generally speaking, the hour, or time, lines are curved. Some time ago a recording instrument was patented by Murday, and is manufactured by Messrs. Evershed and Vignoles, which gives rectangular co-ordinates. Fig. 6 illustrates the method by which rectangular co-ordinates are obtained.

Protective Relays.

The problem of the protection of electrical plant, feeders, etc., against faults or abnormal conditions is of growing importance at the present time. The success of any protective scheme depends largely on the reliability and suitability of the relays employed.

The trend of development in the design of modern protective relays is along the line of making the operating element of the relay more sensitive and stable, and the tripping part more robust and reliable.

Sensitive relays permit lower fault settings to be obtained, are more accurate in calibration, and at the same time consume a smaller amount of volt-amperes for their working.

The development of super-sensitive relays enabled known and well-tried protective schemes to be extended and applied to modern extra-high-pressure systems, on which bushing-type current transformers of limited ampere-turns are invariably installed. Messrs. Nalder Bros. & Thompson, Limited, in particular, amongst others have developed a complete line of super-sensitive relays suitable for all forms of protection and for all purposes.

Protective relays are generally classified according to the functions they perform, or according to the principles on which they are constructed.

Most of the "over" and "under" current or voltage relays at present in use are of the electromagnetic or of the induction type, and a large proportion of these are fitted with some form of time-delay device.

Amongst directional relays the reverse-current relay is perhaps the most important. Until recently this class of relay has been manufactured by various makers in the dynamometer type, and has been arranged to give a characteristic curve approximating to that illustrated in fig. 7.

The dynamometer-type relay is in process of being superseded on account of the excessively high volt-ampere consumption under normal conditions. The total consumption of the current element at 5 amperes and the voltage element at 110 volts 50 cycles generally exceeds 100 VA.

In the most modern development of reverse-current relays, an almost negligible amount of power is required for their working; they give the same performance curve as shown in fig. 7, and operate with greater reliability, particularly in the region of low voltage. This feature is of the greatest importance in cases where the relay has to operate from bushing transformers.

A new class of protective relay is now coming to the front termed the "impedance relay." The time of operation of this is directly proportional to the impedance or the distance from the relay to the point of short circuit.

In order to prevent interruption of supply due to a sudden surge or high-frequency transient effect occurring on the system to be protected, special forms of anti-surge relays have been designed and are manufactured by various firms. Messrs. Nalder Bros. and Thompson, Limited, have also developed a series of special relays such as frequency and power-factor relays and automatic synchronising relays.

Electricity Supply Tariffs.

Some particulars of the various deferred-payment agreements and electric light and power tariffs in force at Basle, Switzerland.

By Professor W. CRAMP.

(*Concluded from page* 127).

It is difficult to compare this power tariff with a straight m.d. system, but instances will show how low are the terms. For example, an engineering works might have a load factor of 20 per cent. and an m.d. of 1,000 kW. The price on the Basle basis would be 0.86d. per kelvin; most English undertakings would charge at least 1.2d. I was recently instructed to negotiate the supply of electric power to a works requiring four million kelvins per annum, with an estimated load factor of 50 per cent. and power factor of 80 per cent. The best terms I could obtain were £5 5s. per annum per kVA of m.d., plus 0.35d. per kelvin, the basis price of coal being 6s. 6d. per ton. The coal clause was at the rate of .033d. per 1s. per ton. This tariff for the load in question, and with coal at 12s. 6d. per ton, works out at 0.91d. per kWh. The corresponding charge in Basle would be *at the most* 0.68d. No more need be said.

The foregoing are normal tariffs; but to attract the householder and tradesman alike, and to improve their own load factor, the Swiss supply authorities hold out all manner of special temptations. Some of these are annual charges without meters, as, for instance, B (9), (10), &c., below; others involve the use of special time meters and switches.

I.—Special Tariffs with Meters.

B (4) *Electricity for Cooking.*—(*a*) If the householder has adopted the double tariff under B (2) above, and has connected his cooker to the lighting system, then each month as many kelvins are reckoned on the lower tariff as are shown on the higher. All beyond these are supplied at 10 cents (0.96d.) in winter, and 8 cents (0.768d.) in summer. The kelvins per month for cooking must not be less than 10. This is an exceedingly cunning device, since it first tempts the householder to reduce his demand during peak hours and then to cook during off-peak hours, and moreover to cook more in summer than in winter. It may be commended to English supply authorities.

(*b*) The householder may rent a special meter for his cooker at about 1s. per month. He then gets energy for cooking from 6.30 to 9 a.m. and from 4.30 to 8 p.m. at 25 cents (2.4d.); and during other hours at 8 cents (0.768d). Who would cook by gas if we had such a tariff here?

B (5) *Electricity for Bakers' Ovens.*—Bakers' ovens are evidently a coveted load in Switzerland, and moreover some of these are equipped with an alternative system of heating. Tariffs are provided for each kind, and the period of energy supply is from 10 p.m. to 7 a.m. and from noon to 1.30 p.m. The following are the prices of energy:—(*a*) Electric bakers' ovens, from October 1st to March 31st, 4 cts. (0.38d.) per kelvin; from April 1st to September 30th, 3 cts. (0.3d.) per kelvin; (*b*) bakers' ovens with alternative methods of heating, from October 1st to March 31st, 3 cts. (0.3d.) per kelvin; from April 1st to September 30th 2 cts. (.19d.).

If the annual consumption per rated kW connected falls below 45 fr. (36s.) for class (*a*) or 35 fr. (28s.) for class (*b*), the difference must be made up. For class (*b*), however, there is a further provision to the effect that the annual minimum is reduced in the ratio of the number of days on which energy is at the disposal of the baker to the total number of days in a year. This seems to me to be a particularly generous concession.

B (6) *Electricity for Industrial Heating during the Day Time.*—This includes laundry irons, apparatus for drying hair or for coffee machines, and other trade devices. The basis is a double tariff like B (2) above, and the same hours are adopted, but the prices are:—(*a*) Less than 1,500 kelvins p.a.: upper rate 55 cts. (5.3d.), lower rate, summer, 8 cts. (0.768d.), lower rate, winter, 10 cts. (0.96d.). (*b*) More than 1,500 kelvins p.a.: upper rate 20 cts. (1.92d.), lower rate, summer, 8 cts. (0.788d.), lower rate, winter, 10 cts. (0.96d.).

The minimum is 84 fr. (67s. 6d.) per kW per year, and if the yearly demand exceeds 2,000 kelvins, the consumer has the option of adopting the ordinary power tariff (see B (3) above).

To simplify wiring for such installations, the purchaser may have his lighting connected to the same meter, except in those cases where the lighting load during the off-peak hours is likely to be large compared with the heating load, as, for instance, in public houses. This concession, however, does not hold if the power tariff is chosen.

B (7) *Electricity for Window Display and Advertisements.*—For this purpose a double tariff (with the appropriate meter) is offered. The terms are:—From 6.30 to 9 a.m. and from 4.30 to 7 p.m., 55 cts. per kelvin (5.28d.); all other hours, 15 cts. (1.44d.).

The object of the tariff is obvious, and since few such installations would be likely to be required from 6.30 to 9 a.m., the terms are more advantageous than at first sight appears. The supply authority is willing to provide an automatic clock-controlled switch which closes each day at dusk. The circuit can also be controlled by hand, so that the owner can switch off when he pleases. The hire of the automatic switch costs 1.5 fr. (1s. 2½d.) per month.

B (8) *Electricity for Heat Storage Systems.*—This is encouraged in certain cases for the heating of rooms, &c. The current heats a storage system (*e.g.*, special floors or panels) during the night, and these keep the rooms warm during the day. The tariff is 4 cts. (.384d.) per kelvin, with a minimum of 45 fr. (£1 16s.) per annum per kW connected. Such a system may have two "heats." The larger may be three times the smaller, and automatically brought into use from Saturday midday until Sunday evening. For this period the charge is 2 cts. (.19d.) per kelvin! A single heat system may also be used during these extended hours at 4 cts. (.38d.) per kelvin.

II.—Annual Tariffs (No Meter Reading).

B (9) *Electricity for Small Boilers.*—The conditions for the supply, on deferred payment, of two sizes of boiler have been quoted above, A (2). Now either of these sizes may be connected through an automatic switch to the mains, so that current is on from 10 p.m. to 7 a.m. If this is done, then the householder pays an inclusive charge of only 4 fr. (3s. 3d.) per month for the 30-litre boiler and 6 fr. (5s. 10d.) per month for the 50-litre size. Imagine a good continuous hot-water supply for a small house at £3 10s. per year! An additional switch will enable these boilers to be used continuously from Saturday midday until Sunday evening at a monthly charge of 1 fr. (9.6d.) for the smaller and 1 fr. 25 (1s.) for the larger.

B (10) *Electricity for Lighting Premises in General Use.*—Provided metal-filament lamps are used, the charges are as follows:—For lamp c.p. of 16, 25, 32, and 50, the annual charges for energy per lamp are 8 fr. (6s. 5d.), 12.5 fr. (10s.), 16 fr. (12s. 10d.), 25 fr. (£1).

B (11) *Electricity for Lighting Staircases, Corridors, Sign Boards, &c.*—For these purposes the supply authority offers a time switch which automatically closes at dusk and opens at 9 p.m. After this time the light can be switched on by a push-button at the house-door, or the doors of the various flats. Having thus been switched on, the light remains on for three minutes, and then is automatically extinguished. Of course, the latter arrangement is omitted in the case of signboards. The following table gives the annual charges for different numbers of metal-filament lamps, inclusive of rent and maintenance of the time switch:—

Metal-filament lamps connected.	Candle-power of each lamp. Sixteen.		Twenty-five.		Thirty-two.	
	Frs.	Shillings.	Frs.	Shillings.	Frs.	Shillings.
1	36	29	36	29	36	29
2	36	29	47	37.6	56	44.6
3	46	37	62.5	50	76	61
4	56	45	78	62.5	96	77
5	66	53	93.5	75	116	93
6	76	61	109	87	136	109
7	86	69	124.5	104	156	125

These figures are increased by 20 per cent. if the light is kept continuously burning until 10 p.m., and a further 10 per cent. is added for any further time up till midnight. Payments are half-yearly, and as a precaution against cheating, new lamps must be obtained from the electricity works.

There is little doubt that such a tariff as this would tempt many a landlord of flats, especially in London.

B (12) *Electricity for Bells and Door Opening.*—Finally a tariff is provided for a purpose little known in this country. It is very common abroad not only to have electric bells for the outer doors of offices and flats, but also to have a device whereby the latch can be withdrawn and the door opened by remote control from within. For these purposes the electricity authority allows special transformers and provides a special tariff. The transformer must conform as regards construction to the rules of the supply authority, and the

no-load power must not exceed 1 watt. The following is the tariff:—

Cost of energy per annum.

	Bells only.		Bells and door opening.	
	Frs.	Shillings.	Frs.	Shillings.
House of 8 rooms	3	2.4	5	4
House with more than 8 rooms...	5	4	6	4.8
Buildings of maximum 3 flats ...	4	3.2	6	4.8
Buildings of more than 3 flats ...	5	4	7	5.6

How gladly would the English householder get rid of the nuisance of his bell batteries for 3s. a year!

Principle of the Tariffs.

In the preceding paragraphs I have emphasised the benefit to the consumer arising from the very low tariffs, but these are only possible *because time switches improve the load factor*. The principle underlying this improvement is the combination of two rates with a time switch. This is very different in its effect from the two-part tariff. It definitely discourages the consumer from taking power except during those hours which best suit the supply authority, and it achieves the result by a liberal use of time switches. To meet these conditions, the consumer's apparatus must embody the principle of energy storage, entailing the equivalent of the gas-holder. The difference between the gas supply and the local storage system is that in the latter case the consumer pays for his share of the storage required, and for his share only; but he pays for it in a shorter period.

Supply authorities to whom I have mentioned this plan invariably reply with Lieut.-Col. W. A. Vignoles: "Expenditure on meters is unproductive, and should be kept down to the bare minimum." In Switzerland this is not the case. An economic rent is charged for the meter and time switch, and the business becomes profitable. The consumer does not object because the benefits accruing to him are usually out of all proportion to this rent; and if they are not, he can adopt some other tariff. The general effect of the whole policy is shown in the "Jahresbericht des Elektrizitätswerke Basel."

The load factor, though high in 1916, is now higher than would exist in any but the most favourable electrochemical industry, such as the manufacture of carbide of calcium or of carborundum. It is higher than that of some flour-mills. This result, it is claimed, has been brought about by fostering that load which is generally considered to be the worst, *viz.*, the domestic load; and the method of approach is in principle that of local energy storage in the form of heat, rendered possible by engineering initiative in the design of heaters and boilers and of time switches, combined with appropriate tariffs.

Conclusion.—The lessons to be drawn from the foregoing analysis are two. First, it is evident that Swiss engineers, combining their well-known faculty for reliable time-mechanism with the modern necessities of electricity supply, have produced a wonderful series of automatic time switches, which can be supplied at a relatively small cost and can be used even on 6,600-volt circuits. By means of these switches and the principle of energy storage, they are able to offer electrical power at very low rates, far below those in this country, which rates are framed in such a way as to increase the station load factor. It seems clear that we also should adopt similar expedients as rapidly as possible.

Secondly, the electricity authority goes out of its way to be of service to the consumer—especially the small consumer. This policy is clearly shown in the deferred-payment systems for wiring and apparatus, and the many discriminating tariffs for various loads; but it is even more evident in the consideration given to such apparent trifles as bells and door-opening appliances. Surely there is a lesson here also for us—a lesson which is very appropriate at a time when the E.D.A. and the E.L.M.A. are conducting a campaign to advertise the use of electricity. The best possible advertisement for electricity supply is that which results from a meeting between A and B on their way to town in the morning, when A casually remarks: "I arranged a month ago to put such and such an apparatus on the new tariff. It's saving me pounds a year!"

Tests for Resultant Economy.

The Calculation of the ultimate gain resulting from the heating of boiler-feed water by means of steam "bled" from the main Turbines.

By "ESSAYE."

POWER station engineers generally are well aware that considerable economy, in operation, may be obtained by the heating of the boiler feed-water by means of steam "bled" from one or more stages of the main turbine units. That the operating cycle is thereby improved is unquestionable. If, say, 5 per cent. of the total heat in the steam delivered to the turbine is returned, by means of a "bleeder" heater, to the condensate (feed water), it is obvious that 5 per cent. less heat transfer will be required in the boiler plant.

In most stations, however, this will not mean a 5 per cent. reduction in the fuel bill, and the question that arises is: How much of this saving will ultimately be realised?

First, then, the steam consumption of the turbine will necessarily be somewhat increased, due to the "bleeding" of some of the steam before all the turbine stages have been passed. Secondly, where the innovation of "bleeder" heating is made in a station in which the usual large economisers have already been installed, it will be apparent that the higher inlet water temperature to these economisers will render the water unable to extract the same amount of heat from the gases as heretofore. The consequent rise in the gas outlet temperature will, therefore, result in a decrease in the percentage efficiency of the boiler and economiser as a whole.

As the composition and lay-out of the boiler plant must have a largely varying effect on the overall saving, the writer will confine these notes to the problem as met with in a station where economisers only are installed in the flues. The following calculations are therefore put forward as being a simple and straightforward means of arriving at the ultimate gain in such a station. The data for these have been obtained from a great number of turbine and boiler tests taken in a large

modern power station, and the accuracy of these tests is as great as is possible.

The following is the method stated briefly:—

The total steam consumed by the turbine in one hour was obtained from two similar tests, first without "bleeding," and secondly with "bleeding." In each case a figure of 5 per cent. (representing boiler make-up) was added, and the resultant gave the total steam demand from the boilers. The two different feed temperatures (at the economiser inlet) were also noted.

From the boiler tests the evaporation figure, *i.e.*, lb. of water (actual) evaporated per lb. of coal, was obtained for the two different feed temperatures. Then, by dividing these "evaporation figures" into their corresponding steam demand, the total coal required in each case was obtained. The overall gain due to "bleeder" heating was then easily obtained on a percentage basis.

The following are the actual test figures obtained:—

	Without bleeding.	With bleeding.
Load in kW	18,000	18,000
Turbine steam consumption (1 hr.), lb.	188,856	191,160
Total steam demand, lb. ...	198,299	200,718
Temperature of feed, deg. F.	91	150
Evaporation figure, lb. ...	8.182	8.617
Coal required, lb.	24,238	23,300

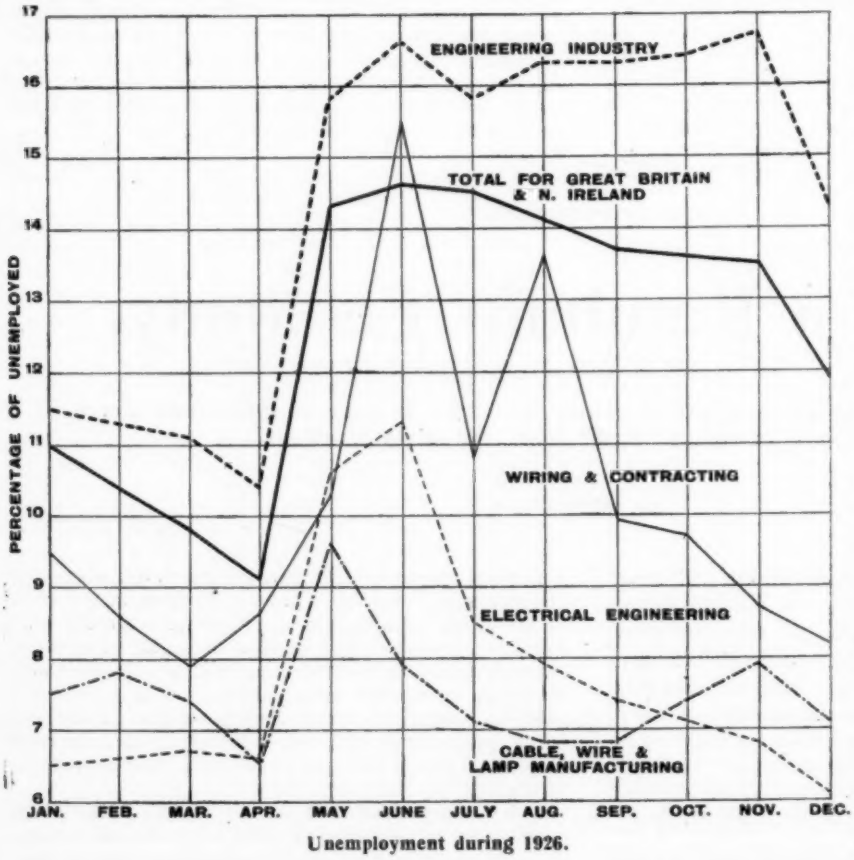
The difference of 938 lb. represents an overall gain due to "bleeder" heating of 3.78 per cent. The figures in the table have been corrected for the inevitable small dissimilarities which occurred in the tests.

Unemployment during 1926.

The Favourable Position of the Electrical Industries in a Troubled Year.

AS was indicated in the foreign trade tables which appeared in our last issue, while British exports generally were very badly affected during 1926 by the industrial troubles which marred the year, electrical exports continued to progress, and were in excess of those of 1925. Even in the months affected by the general strike and its aftermath, all sections of the electrical industry compared well with other industries.

If further testimony is needed, the curves which accompany these notes will provide it. For the particulars from which they are prepared we are indebted to the *Ministry of Labour Gazette*. The statistics of general unemployment are based on the returns of the Employment Exchanges, and these (as well as the others dealt with) are for Great Britain and Northern Ireland. The percentages are derived from the total number of insured persons as at July, 1925 (11,892,000), for the first six months, and from the total as at July, 1926 (12,041,000), for the latter half of the year. This change of basis also occurred in the individual industries, necessitating the use of percentages rather than numbers.



Unemployment during 1926.

Dealing with the curve showing the state of unemployment as a whole, it will be seen that during the first quarter of the year the percentage fell at a regular rate from 11 to just over 9. Then came the general strike and the commencement of the coal stoppage, which sent the figure up to 14.3 per cent. In June it went slightly higher, and then gradually fell until December, when it made a sudden descent, which continued during January. The level of unemployment in the engineering industry as a whole was above the general figure during the whole of the year, and for the greater part experienced similar fluctuations; the improvement towards the close of the year was very marked. The curve indicating the state of employment in the electrical engineering industry stands out in marked contrast to the others. Commencing at 6.5 per cent., it kept well below the general and engineering figures, and at its highest (in June) was only 11.3 per cent., when the national figure was 14.6 per cent., and that for the engineering industry was 16.6 per cent. The section least affected by the industrial upheaval in May was the

electric cable, wire and lamp manufacturing group. Unemployment in this section went to 9.6 per cent. in May, but there was a swift recovery, and the position remained comparatively satisfactory until October and November, when there was a rise to 7.8 per cent. In common with the other groups, however, there was a decided improvement in December, and the final position was better than at the beginning of the year. The most violent fluctuations occurred in the wiring and contracting industry. Opening in a satisfactory manner, the percentage of unemployment rose enormously in April, May and June, and after a great improvement in July, again went up. In September there was another large fall in unemployment, and this was maintained at a slower rate for the rest of the year.

To afford the reader some idea of the magnitude, as distinguished from the proportion, of unemployment in the groups with which the curves deal, we may give the actual numbers upon which the last points of the curve are based; these are as follows:—General, 1,431,840; engineering industry as a whole, 143,503; electrical engineering industry, 4,686; electrical wiring and contracting, 1,141; and electric cable, wire and lamp manufacturing, 6,274.

Legal.

British Thomson-Houston Co. Litigation.

IN the Chancery Division, on January 28th, Mr. Justice Astbury granted an injunction until the trial of the action, the British Thomson-Houston Co., Ltd., against Green & Co., Leeds, restraining the defendants from infringing plaintiffs' letters patent relating to the gasfilled lamp. The defendants did not appear.

His LORDSHIP also granted an injunction *ex parte* in the case of the British Thomson-Houston Co. against P. M. Braidwood, Barnet, restraining the defendant from infringing plaintiffs' leading-in wire patent and the gasfilled patent. Leave was given to serve defendants with notice of motion for February 4th.

Mr. Trevor Watson appeared for the plaintiff company in both cases.

The West Yorkshire Electric Co. and Mr. J. G. Ritchie, of Leeds, were defendants to a motion before Mr. Justice Tomlin, in the Chancery Division on January 28th, by the British Thomson-Houston Co., Ltd., which claimed an injunction restraining alleged infringements of its leading-in wire and gasfilled lamp patents.

Evidence was read that a dozen lamps were bought by an agent of the plaintiff company at the back door of the defendants' premises, Mr. Ritchie producing them from a cellar.

Mr. RITCHIE denied that he had done anything wrong, and he asked for time to consider the plaintiff company's evidence.

His LORDSHIP adjourned the motion for a week for this purpose, but continued in the meantime the *ex parte* injunction restraining the defendants from parting with any infringing lamps still in their possession.

A Wiring Contract Dispute.

IN the Mayor's and City of London Court, before the Common Serjeant, Sir H. F. Dickens, K.C., on January 25th, a claim was made by Messrs. Margolis Fulberg & Budd, electrical engineers, 163, Wardour Street, against Mr. C. T. Colpitts for £41 15s., balance due in respect of electrical wiring and fittings supplied to a flat at 53, Lancaster Gate. The defendant admitted in respect of alterations to wiring a sum of £23 15s., also £21 15s. of which total of £45 10s. a sum of £40 had been paid, leaving a balance of £5 10s. The plaintiffs' case was that they were engaged by the landlord of the premises at 53, Lancaster Gate to do electrical wiring work when arranging for the house to be converted into a number of flats. That job was practically completed at the time the contract in the present case was made. Before that contract, plaintiffs had fitted certain of the electric wiring for the installation to lath and plaster partitions which were afterwards condemned. The defendant, a tenant of one of the flats, agreed with the plaintiffs to carry out alterations to the wiring. In the course of carrying out that work, the lath and plaster partitions were demolished, and breeze slab partitions re-erected in their place. In carrying out the defendant's instructions, the plaintiffs said, the flat had to be entirely rewired. It was also much more difficult to deal with a breeze slab partition than with one of lath and plaster. The defendant contended that some of the work claimed for by the plaintiffs was not necessary.

Mr. COLPITTS said that he did not know anything about scrapping the lath and plaster partitions in the building, and replacing them by breeze blocks. He had told the plaintiffs' representative, when the partitions were pulled down, that he (witness) would have to pay for re-instating the electrical wire, but he was never told that the flat would have to be rewired throughout. He put the amount he was liable for at £23 15s.

Mr. R. F. HAYDEN, F.S.I., considered that the cost of work rendered necessary by the removal of partitions was £20 5s., and for sinking switch boxes into breeze blocks he thought £3 10s. would be sufficient.

Mr. F. FIELD, manager of the electrical department of Messrs. Sims & Sims, electrical engineers, Gloucester Gate, said that in his opinion £20 was the cost of work rendered necessary by the alterations in the partitions. For ordinary slip tube installation work, whether chased into walls or not, a normal price would be 22s. per point, but for first-class screwed barrel work the price was 30s. to 32s. per point.

The COMMON SERJEANT said that the plaintiffs had failed to satisfy him that the work which they did was necessary, or that the price of £2 10s. per point was reasonable. He found that the sum allowed by the defendant of £23 10s. was the outside price to charge, and therefore the amount which had been paid was sufficient. Judgment was entered for the defendant, with costs.

Damages Awarded Against the Cork Tramways Company.

IN the Circuit Court at Cork, before Judge Kenny, on January 26th, Mr. A. P. Morgan, proprietor of the Cork Motor 'Bus Services, sued the Cork Electric Tramways and Lighting Co., Ltd., for £100 for damage to one of his 'buses, by reason of negligence and the reckless driving of one of the company's cars, and for consequential loss suffered owing to the collision. There was a counter-claim for £1 16s. 10d. in respect of damage to the tramcar, in the collision with the 'bus. After hearing the evidence at great length, Judge KENNY said he was satisfied that the collision with the 'bus was due to the negligence of the tramcar driver. He was strongly of the opinion that the driver of the tramcar did it maliciously, but he certainly did it negligently, and therefore the defendant company was liable for £35 damages. Judgment was given for that amount with costs and expenses. The counter-claim was disallowed.

Alleged Fraudulent Use of Electricity.

IN the Falkirk Sheriff Court, last week, a local licence-holder was charged at the instance of the Corporation with fraudulently altering the index of an electricity meter and preventing it from registering the quantity supplied, and fraudulently using 71 kWh of electricity. He pleaded "Not guilty," and evidence was heard at great length, the witnesses including Mr. T. M. Climie, the burgh electrical engineer, and Mr. R. J. Taylor, superintendent of the testing laboratory of Glasgow Corporation. For the defence it was denied that there was any interference with the meter. The Sheriff adjourned the case until February 7th.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Wattmeter Calculations.

Referring to the objections raised by your correspondent, Mr. D. Robertson, under the numbers which he gave them:—

1. In order to allow for the power consumed by the volt-coil "by simple subtraction," it is obviously necessary also to know the p.d. across the volt-coil, which is the same (in this case) as the load voltage, and Mr. Robertson, under (4) states quite correctly that this "is very troublesome, even when possible." It appears, therefore, as if he refutes his own argument.

2. This again depends on knowing the load voltage, and thus comes under the same heading as the above.

3. It is not desirable to allow the coils of a precision wattmeter to attain a 50-degree Centigrade temperature rise, necessary to produce the 20 per cent. change in resistance mentioned by Mr. Robertson, and in any case, the figure refers to *an error in an error*, and so is less formidable than might appear.

4. It is somewhat difficult to see in what sense this statement applies to the one method more than the other, seeing that the end of the current-coil to which the volt-coil is connected has no bearing whatever on the difficulty or otherwise of measuring the load voltage.

5. It would hardly be thought necessary to point out that figs. 1 and 3 are theoretical circuit diagrams, and do not supply the information regarding the precise disposition of the leads which Mr. Robertson appears to extract from them. Apart from that, he does not appear to have noticed that currents heavy enough to warrant consideration of contact resistance are specificially ruled out in the first paragraph of the article, as the errors in question are then negligible.

As pointed out in the article, the accuracy of the graphical corrections was not allowed to depend on mere theory, but was

carefully checked by experiment with standard apparatus representing a large variety of conditions. It is not always appreciated that in work of this kind the introduction of any ordinary form of a.c. voltmeter or ammeter completely alters the circuit conditions, and that therefore methods legitimate in general electrical practice do not apply.

Blackheath, *January 25th*, 1927. **Marcus G. Scroggie.**

Power Supply for Wireless Sets.

I was very much interested in the letter published by you, dated January 15th, from Mr. A. O. Griffiths, the more particularly as my own experience has been entirely different to his.

I changed over from so-called "dry batteries" to an accumulator six months ago. Under advice I was careful to have my accumulator recharged frequently, and at the end of four months I came to the conclusion that I preferred the dry battery, which gave me no trouble from recharging, and which, when exhausted, I was able to renew at a moderate expense.

I am satisfied in my own mind that a dry battery is cleaner, freer from trouble, and less expensive than an accumulator for the high-voltage supply.

Enfield, *January 24th*, 1927. **E. Rowbotham.**

I have read the letter of "Interested" in your issue of January 28th. It is a little difficult for me to reply adequately to this letter, for its writer does not commit himself to definite statements. He *thinks* that some statements of mine should be challenged: he *thinks* that the human ear . . . . . should be the final judge: *to his mind* his apparatus is distortionless, &c. Of course, he is entitled to his opinions, whatever they may be, but, since he has published them, perhaps I may be permitted to discuss them.

I will take first his statement: ". . . I am now using instruments which, to my mind, give absolutely distortionless reproduction of both speech and music. . ." As I have said, it is not for me to discuss the state of "Interested's" mind: I can only deal with facts. Putting aside the extreme improbability that there ever has been or ever will be an "absolutely distortionless" receiver, let me ask "Interested" on what facts or tests he bases his opinion?

Has he had the opportunity to take these instruments up to Savoy Hill, and listen to the performance with an instantaneous change-over to its reproduction on his set? If not, any claim for complete absence of distortion is simply ridiculous.

It is probable that about the nearest approach to distortionless reproductin at the present moment is the set at the South Kensington Museum, which has been built regardless of space and expense: but I know that its designer will be the first to admit that some distortion still exists in it. In fact, most of the distortion can be calculated from the circuit diagram.

Again, in his opinion "that the human ear, provided it be competent, must be the final judge as to whether a broadcast receiver is distortionless or not," he begs the whole question, for it is a fact undisputed by those who have studied the subject that there is no record of any human ear being competent in this sense. All the tests which have been made go to show that even at the easy task of judging the strength of a pure note, when the strength is changed instantaneously (the easiest test of all), the ear can hardly ever detect a change of less than 10 *per cent.*, and that the ear passes as correct complex sounds of which some components may be proved to be 50 *per cent.* below their proper amplitude.

Certainly the ear is the final judge as to *whether certain reproduction pleases that ear's owner*: but that is a totally different matter, which I have not discussed in my contributions.

It is notorious that some people prefer a distorted reproduction; for example, many prefer their music made "mellow" by having the high harmonics cut down. But since there is no hope of forecasting in advance what the majority will prefer, I have always gone on the principle that the nearest possible approach to a true reproduction is the best thing to offer.

It appears to me that "Interested" shows such a complete lack of appreciation of what "distortionless reproduction" really is that it is unnecessary for me to discuss the methods by which he claims to have achieved it.

P. K. Turner.

Blackheath, *January 29th*, 1927.

For an amateur my experience has been a fairly extensive one; I have had several sets and many different types of valves, and have used both dry batteries and accumulators for h.p. Many months ago I finally discarded the latter as being far too messy and troublesome. I am now a confirmed believer in the dry battery, as no attention at all is necessary for months on end, and in 90 per cent. of the sets used it is certainly less expensive in operation.

Where a few enthusiasts go wrong is in changing their valves for the modern high emission power valves; these are, no doubt, excellent in their way, but in my opinion the extra running costs are not compensated for by the little advantage obtained.

If you must have these, see that a dry battery of ample proportions is used. You do not expect to run an 80-h.p. car with the same petrol consumption as that taken by the more modest "ten." Apply the same reasoning when you select your high-voltage dry batteries.

Your correspondent himself condemns the use of accumulators in his second paragraph.

London, *January 25th*, 1927. **R. S. Stanley.**

River Water—or Cooling Towers?

In his letter in your issue of January 28th, 1927, Mr. R. J. Kaula doubts if the values assigned to vacua in the article on "River Water—or Cooling Towers?" could be substantiated by calculations. If the values assigned to the basis of vacua in the article, namely, an average recooled water temperature of 75 deg. F., and an average river water temperature of 50 deg. F., are admitted as being reasonably accurate values, then Mr. Kaula may find his doubt removed if he will refer to fig. 2 in the book on "Condensing Plant," the joint authors of which are R. J. Kaula and I. V. Robinson. The values assigned in the article to vacua corresponding to given inlet temperatures are based upon the results of tests on many makes of modern condensing plant by the writer, and fig. 2 in Mr. Kaula's book gives values substantially in accordance with those in the article. The differences between the values given by fig. 2 in the book referred to, and those assigned in the article are too small to affect the main issue.

In passing, Mr. Kaula comments that the article neglects to make any allowance for the power required to pump the circulating water to cooling-tower level, and states that this power will be practically 1 per cent. of the steam consumption of the main unit, thus implying that there is a debit of 1 per cent. against the cooling-tower station on this account. It needs little consideration to show that that is not the case. There is a difference in the circulating-water quantities in the two cases, for which due allowance was made in the article in assigning the values of vacua, and if this difference of water quantity is taken into account, the difference in the power taken by the circulating pumps falls to about 0.5 per cent. as a maximum. In most practical cases, owing to reasons outside our present scope, the difference would be less than this maximum value of 0.5 per cent. This point was investigated when writing the article, and the writer arrived at the conclusion that the difference in pump power for most comparative cases would be of the order of about 0.3 per cent., with a maximum value of 0.5 per cent. It was therefore deemed to be not worth while introducing this detail, for, if it were introduced, then to do full justice to both cases it would be necessary to compare relative capital and running costs, and it was desired to keep all reference to costs out of the article.

Mr. Kaula points out that the half-load figures in fig. 1 prove that practically the whole of the theoretical gain can be achieved, given a correctly designed low-pressure end. The writer would point out that the corollary to this is that to achieve the same result at full load would necessitate increasing the low-pressure blade area by about 90 per cent.—practically double. At the present time turbine designers find it impracticable to do this in a commercial turbine.

Mr. Kaula states that turbine builders all over the world are prepared to guarantee their ability to build turbines which will utilise the heat energy efficiently down to 0.9 in. Hg., and even below. If the word "relatively" were inserted before "efficiently," the writer could agree, but would point out that this is not the same thing as guaranteeing a definite gain accruing from lowering the terminal pressure from, say, 1.8 in. Hg. to 0.9 in. Hg. abs., which is the basic requirement from the point of view of the article. The writer makes bold to state that no such guarantee has ever been given in this country for modern plant. It may, or may not, be news to Mr. Kaula that if a prospective turbine purchaser drew up a turbine guarantee schedule calling for guaranteed steam consumptions at, say, 0.9 in. Hg. and also at 1.5 in. Hg., then not one of the turbine builders in the B.E.A.M.A. would give such a guarantee. The writer has tried to obtain such a guarantee, and every firm in the B.E.A.M.A. has refused to give it. The writer does not infer that turbine builders do not know the value of altered conditions—they obviously must know, or they could not give their ordinary guarantee—but the writer does believe that they are not particularly anxious that the purchasers should know the true value of conditions. The remedy is in the hands of the purchasers and consists in following the example of the writer by determining these values for themselves.

The article did not state or imply that turbine builders, as a body, were mistaken in the results they could obtain for given conditions, as inferred by Mr. Kaula; to do so would obviously be absurd. Neither did it state or imply that the results presented could not be improved on in the future. Bleeding the turbine for feed heating will tend to increase the difference between the two cases. The article presented the case as it stands to-day, and made no speculations to what the position would be years hence. As realised by Mr. Kaula, the article stands or falls by the test results given in fig. 1. To disprove the results arrived at in the article, it is necessary to produce authentic test results, showing immensely improved performance *at full load* over the range of vacua assigned. Mr. Kaula produces no such results, but merely a blind faith in the ability of turbine builders. The writer prefers to put his faith in reasonably accurate test results.

Stoke-on-Trent, *January 28th*, 1927. **J. N. Waite.**

Electrical Activity at Trafford Park.

MUCH has been said recently regarding the greatly increased volume of business that is receiving the attention of British electrical and allied manufacturers. The accompanying picture will convey more readily than many written paragraphs the real state of affairs at one big factory at Trafford Park. It shows the large electrical aisle at the works of the Metropolitan-Vickers Electrical Co., Ltd. The photograph speaks eloquently of the large amount of work in progress in the shop, and also to some extent indicates the size of the aisle, though we have not been able to include the full view of the galleries. At the time of the Manchester Civic Week we gave some notes regarding the big work that was in hand at this factory (see ELEC. REV., October 15th, 1926). Since that time we have recorded the placing of many further large contracts with the company for railway electrification and other operations.

The Electrical Aisle at the Metropolitan-Vickers Works at Trafford Park.

Among the latest orders received by the company is one for electric winding equipment to be installed at the Bedlay Colliery, which is part of the important group of collieries, coke-ovens, and ironworks of Messrs. William Baird and Company, Coatbridge, near Glasgow. The winder will be of the a.c. geared type, with a motor of 280 h.p., operating at 570 r.p.m., and driving through double helical single-reduction gear, giving a speed of 61.8 r.p.m. on a cylindrical drum of 10 ft. 6 in. diameter. The depth to be worked is 1,188 ft., and the winder is to deal with a gross load of about two tons during the sinking operations, and a net load of one ton when carrying men when the shaft is put into work. The equipment will include a Metropolitan-Vickers liquid controller with automatic accelerating gear, and pillar-type switchgear; a Lilly overwind and overspeed device will be fitted. The mechanical parts and equipment for oil braking will be supplied by Messrs. Robey & Company, Ltd. The consulting engineers for the installations are Messrs. Stevenson & McCuffie, of Glasgow. It is of interest to note that the group of collieries and works of Messrs. Wm. Baird & Co. generates its own electric power at the Company's main station at Gartsherrie, which is equipped with two 3,000-kW Metropolitan-Vickers turbo-alternator sets. From this station power is transmitted at 11,000 volts to Bedlay and the collieries and works in the Kilsyth area. Metropolitan-Vickers electric winders are already in use at collieries on the system.

Sir P. Nash on the Electrical Industry.

Sir Philip Nash lectured on January 25th to the Metropolitan-Vickers College Apprentice Association, consisting of over 100 men selected from the principal universities at home and abroad. He said that in less than 100 years over £750,000,000 had been invested in the electrical industry by this country alone, and to-day there was hardly any phase of modern life that did not materially benefit from the extended use of electricity. In 1880 the largest electric generator was of 60-kW capacity, and to-day a single unit generator of 60,000-kW capacity was at work, and designs had been made for a set of 200,000-kW capacity. He anticipated that for this country alone over 30,000,000-kW capacity of turbines, generators, transformers, and motors, besides switchgear, would be required as a result of the developments expected to result from the new Electricity Act. Referring to the Metropolitan-Vickers Company, he said that more than half of its business came from abroad, and that much apparatus for export had to meet more onerous conditions than those met with in this country. He looked to the apprentices to fit themselves to play their part in maintaining the progress of the industry, and strongly advised them to develop the human side by studying very carefully their duty to each other and to the workmen.

Business and Industrial Notes.

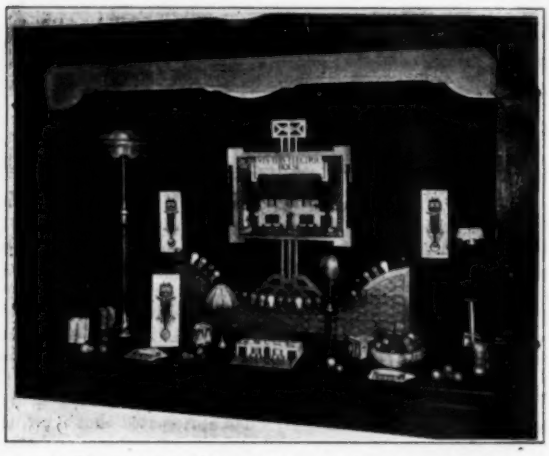
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official report for the week ended January 29th states that the Sheffield demonstration house was opened by the Lord Mayor, and a full electrical page with photograph of the house appeared in the *Sheffield Daily Telegraph* on January 25th. The Leicester demonstration house has been a great success; the average daily attendance has been 300, and a large number of genuine inquiries have been made and actual orders have been received for wiring houses. Bristol is considering running two demonstration houses in the suburbs, and another will be opened at Bath on February 7th. Competition books are being distributed and tramcar advertising is taking place in Douglas, Isle of Man. Southport is making preparations to increase the amount of campaign publicity. Bradford, as a result of a special window display, has increased the number of applications for competition booklets. A special window display in a London contractor's window has produced the following results:—Applications for competition book from commencement of campaign until January 24th, 12; during five days ended January 31st, 280. The display is of a very simple character, and particulars will be sent to any supply undertaking or contractor upon application to the E.D.A., 15, Savoy Street, Strand, W.C.2. On all hands there is evidence that immediate and good business is accruing as a result of the booklet applications. Very satisfactory reports are also coming to hand with regard to the amount of business being done and inquiries being received at the demonstration electric houses.

The total number of visitors to Glasgow demonstration house during the first week was 4,126. Owing to the stormy weather experienced in Glasgow during last week, only about 2,100 people attended. It will interest organisers to know that a telephone has been installed free of charge, and free insurance was also given by the Ocean Accident and Guarantee Corporation. Four transparent posters have been put on every tramcar in Glasgow. Apart from the Wolverhampton Exhibition referred to below, an electrical exhibition was opened on January 31st, at the new showroom of the Corporation Electricity Department, Paisley.

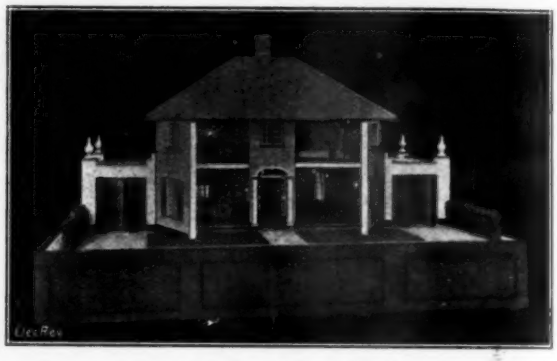
One of the most active centres in the campaign is the North-East Coast area, to which these notes have made frequent reference. An illustration of one phase of the work being



A Newcastle Lighting Service Bureau Window.

done in that area is reproduced herewith. It shows a special window display arranged by the Newcastle-upon-Tyne Lighting Service Bureau. The poster depicting the prize house is the dominant feature, and a model of the house is also given prominence. These are supported by lamps and cartons of various makes and colours, while the actual employment of electric lamps is exemplified by four different standards. Copies of the competition booklet also appear.

In our last issue we reported that Headquarters had had a model of the prize house constructed and fitted for exhibition in the provinces. We are now able to reproduce a photograph of the model, from which it will be seen that a great deal of work has been put into it. The model should certainly



A Model of the Prize House.

stimulate public interest in the competition and inculcate a desire to be the possessor of such an excellent residence.

Another model house is being used by the Birmingham Circle. It is fully equipped for electric lighting and heating, and, in the hands of a capable demonstrating staff, it is to tour Birmingham and suburban districts for a period of several weeks. It is mounted on a motor lorry, and will be flood-lighted at night. The scheme was discussed at a special meeting of chairmen and officials in the South Midlands Area of the Campaign, which was held at Dale End, Birmingham,

A Model Prize House at Birmingham.

last week, Mr. R. A. Chattock presiding, and it was decided that after a period of service in Birmingham and district the model house should be loaned out to other circles at a nominal charge. The Birmingham Committee also has in view the opening of about five more demonstration houses in various parts of the city in the near future, and the beneficial results of the previous houses was referred to by Mr. Chattock at the meeting mentioned above. The Campaign is being warmly supported by the Wolverhampton Corporation, which is collaborating with local traders in an exhibition; a special meeting under the auspices of the Electrical Association for Women was held during the exhibition, at which Lady Bird presided and Mr. V. W. Dale (E.D.A.) lectured.

A further, illuminated, model of the house appears in the window of the Ludgate Hill showroom of the City of London Electric Lighting Co., Ltd.

The Hendon Electric Supply Co., Ltd., conjointly with the Hendon Circle, is organising an electric house. The house will be fully furnished, and electrically equipped throughout. The General Electric Co., Ltd., has undertaken to supply a large number of fittings and appliances. It is intended that this demonstration house shall be open for a period of three weeks, but this period may be extended if the circumstances warrant. It is proposed to erect a special two-way electric sign on the house—which will be readily seen from the railway—in order to draw attention to it.

An electrical exhibition, promoted by the Wolverhampton Corporation Electricity Department, with the co-operation of local contractors, was held at the Baths Assembly Rooms last week. At the opening ceremony on January 27th there were present the Mayor (Alderman F. A. Willcock), Sir Robert Bird, M.P., and Mr. G. R. Thorne, M.P., the first-named declaring the exhibition open.

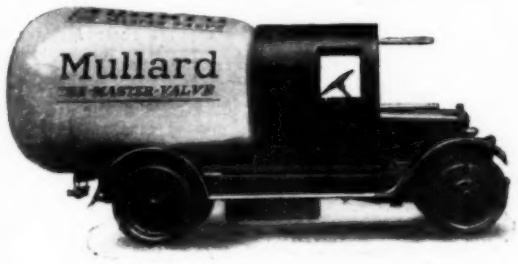
Mr. Ernest Morgan, the Wolverhampton borough electrical engineer, who presided, referred to the assistance of the electrical contractors, and said that the exhibition was almost entirely domestic in its appeal, because the industrial world had learnt the benefits to be derived from the use of electrical energy years ago.

The Mayor said that Wolverhampton had one of the finest power stations in the country, and the aim of the Corporation was to supply current to consumers at as cheap a rate as possible. The exhibition would demonstrate what could be saved by the use of electricity in the home. Sir Robert Bird, M.P., remarked that Wolverhampton had already taken steps to do what the Electricity Act was out to do for other parts of the country. Mr. G. R. Thorne, M.P., also spoke.

During the three days the exhibition, which proved of great interest, was well attended by the public. The following contractors co-operated in the display:—Messrs. Coley and Swinnerton, H. Cooper, W. H. Podmore, C. Gordon Smith, H. H. Speke, Smith & Bellhouse, E. Wilson, and the Midland Electric Power Installation Co.

An Effective Advertising Van.

The accompanying illustration shows one of the new type of delivery vans recently put on the London streets by the MULLARD WIRELESS SERVICE CO., LTD. These are examples of an effective method of impressing a company's name and



A New Mullard Delivery Van.

product upon the minds of the public. The idea is, of course, not entirely novel—one or two electric lamp makers already have vans of this type in service—but that does not lessen its value as a propaganda medium.

Social Events.

The staff of Le Carbone held its annual dinner on January 21st, at the Boulogne Restaurant, London. A concert and dance followed, which were very much enjoyed by a large party.

A whist drive and dance were held on January 27th, at the Parade Café, organised by the Bradford Corporation Electricity Department. About one hundred of the staff and friends attended. Alderman and Mrs. Longley were present, and the alderman presented the whist prizes. After supper, conducted by Mr. C. E. Allsopp, the company took part in community singing.

The annual dinner of the Engineering Staff Association of the Fife Electric Power Company was held at Dunfermline on January 27th, when Mr. T. C. Hunter, chairman of the Association, presided.

On January 28th 50 couples attended the annual dance of James Scott & Co., electricians, Dunfermline.

The annual Bradford Corporation Tramwaymen's concert took place on January 26th, at the Eastbrook Hall, and was attended by a very large audience. The Deputy Lady Mayoress of Bradford (Mrs. David Walker), the chairman of the Tramways Committee (Mr. Irvine Smith), and the general manager of the tramways (Mr. R. H. Wilkinson) were among those present. The artistes were Miss Mavis Bennett (soprano), Miss Enid Cruikshank (contralto), Mr. Dennis Noble (tenor), of the British National Opera Company, Mr. Frank Webster (baritone), Miss Almena Marshall (flautist), Miss Belle Davidson (violin), and Mr. Charles Stott, accompanist and organist.

The second annual dinner of the staff of the West Gloucestershire Power Co., Ltd., was held at the Swan Hotel, Lydney, on Saturday, January 22nd. The general manager and chief engineer, Mr. H. S. Ellis, was in the chair, supported by Mr. M. F. Carter, Supt. Shellswell, and other guests. Mr. M. F. Carter, of Newnham, proposing a toast to the company, said that the company's area of supply was some 600 square miles, in which it had made steady and satisfactory progress. The chairman, in replying, referred to the substantial progress made during the past year in spite of the industrial trouble in the country. During the evening Mr. Ellis presented (on behalf of the whole of the employés) a leather expanding suitcase to Mr. G. A. Harrison, district engineer, who has resigned, having obtained a position abroad. The concert included the first performance of the company's Amateur Dramatic Company.

The British Industries Fair.

Many new matters of interest will be seen at the Birmingham section of the Fair this year. As we have reported, an additional area of 120,000 sq. ft. has been enclosed at Castle Bromwich, and some hundreds of workmen are engaged on the installations for lighting, heating and power for exhibitors' use. A "perfect boiler house," one of the principal exhibits in the new Steam Power Section, alone occupies 15,000 sq. ft. Among the working exhibits will be the "cheapest power pump in the world," single- and three-phase motors with special high-torque rotors of a type not previously made in this country, electric drills of special design for use in confined situations, automatic electro-plating plant, electro-medical appliances which have hitherto been imported, apparatus for the critical matching of colours and for testing their "fastness," and the manufacture of electrical porcelain from the raw clay to the finished article. The domestic side will also be well represented, and we are promised "gas and electric fires with no visible metalwork"; an "electric kettle which reduces the boiling time to half that of other kettles, while using less current"; and "new electric geysers with interlocked switchgear, absolutely foolproof, however careless the user."

Ideal Homes Exhibition at Norwich.

Considerable interest is being aroused in Norwich and district in the Ideal Homes Exhibition which has been arranged to take place at Norwich from February 8th to 19th, inclusive. It is hoped that an appreciable stimulus will be given to the idea of electricity in the home as a result of it throughout the Norwich area. Messrs. Mann, Egerton & Co., Ltd., are making a special display, and the General Electric Co., Ltd., is supplying that company with a complete range of "Magnet" household electrical appliances, together with "G.E.C." fittings, for this purpose.

For Sale.

Norwich Corporation Electricity Department has for disposal three Babcock & Wilcox drum marine type boilers, each 27,000 lb. per hour capacity, fitted with chain grate stokers, B. & W. oil-burning apparatus with pumps, heaters, &c., and one induced-draught fan and motor. Reigate Corporation Electricity Department has for disposal surplus generating plant installed at the Electricity Works, Wray Common Road. Ilford Corporation Electricity Department invites offers for the dismantling and removal of two 500-kW, d.c., Willans-English Electric generating sets, condensing plant, switch panels, &c. Edinburgh Corporation Electricity Department invites offers for 55 tons of battery plates, 11 tons sheet lead, and 7 tons peroxide of lead. Mr. H. J. Shaw will sell by auction on February 9th and following day, at 13, High Holborn, W.C., various wireless and electrical trade stocks and plants. By order of the liquidator of Seagull, Ltd., Mr. G. R. Lightfoot will sell by auction on February 11th, at 5, Newcastle Place, Edgware Road, W., the lease, plant, stock, &c. (See our advertisement pages to-day.)

Chinese Notes.

The Eastern Radio Supply Co. recently commenced business at 6, Pu An Lee, Rue Colbert, Shanghai. It deals in all kinds of radio supplies and manufactures minor accessories.

The Shanghai-Paoshan Electric Co. is being organised with a temporary office at A112, Peking Road, Shanghai. The company has a capital of $1,500,000, and intends to construct street-car lines to connect the Shanghai and Paoshan districts.

Electrical Plant for Mexico.

The National Irrigation Commission, appointed to inquire into existing plant and the provision of future electricity works, mainly for irrigation purposes, in northern Mexico, has presented its report to the Government. It is understood that it contains strong and unanimous recommendations for the expenditure of further large sums on development over a large area. If the report is acted upon, a strong demand will arise for construction material and electrical plant and equipment, stocks being at present unusually low. In view of the present relations between Mexico and the United States it is thought that British manufacturers of electrical machinery having representatives on the spot would have a good chance of securing orders, apart from the particular favour with which British manufactures are regarded in Mexico.—*Reuter's Trade Service* (Mexico City).

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Recent Contracts.

In connection with the large contract awarded by the Southern Railway to the Metropolitan-Vickers Electrical Co., Ltd. (*vide* ELECTRICAL REVIEW, December 31st, p. 1076), the latter company has given an order to the Westinghouse Brake and Saxby Signal Co., Ltd., for 232 motor-driven air compressors and a similar number of air-pressure governors for use in the motor coaches which the Metropolitan-Vickers Co. is supplying.

Among the orders recently executed by the Chloride Electrical Storage Co., Ltd., is one for six large batteries, each consisting of 114 cells for six locomotives at a mine in Chili, high up in the Andes. The climate is a trying one; no rain has fallen in that part of the country for hundreds of years. The company has recently shipped to another South American customer 13 locomotive batteries consisting of 100 cells each.

Civic Week at Fulham.

The Fulham Borough Council is organising a Civic Week to be held from February 5th to 12th. During the week there will be held at the Town Hall lectures, concerts, and an exhibition of local arts and crafts. At the Public Baths an Industrial Exhibition is being arranged; this will be opened by the Lord Mayor of London. The stalls will be arranged and supervised by Fulham manufacturers and producers, and the Electricity Department has taken a large stall, on which it is setting up a dining room, bedroom, and kitchen. In the last compartment electric cooking demonstrations will be given twice daily.

Calendars and Diaries.

We have received from the ENTERPRISE MANUFACTURING CO., LTD., Grape Street, Shaftesbury Avenue, W.C.2, a calendar bearing a humorous illustration and monthly date sheets.

The 1927 calendar of MESSRS. PETTERS, LTD., Yeovil, has a large sheet for each month bearing illustrations of examples of the company's engines and generating sets.

The principal feature of a calendar received from the CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1, is a picture of a "Little Giant" portable electric drill. There are monthly date sheets, each of which bears a calendar for the previous and succeeding months.

Trade Announcements.

MR. OSCAR BEABEY, late manager of Messrs. Troup, Curtis and Co., Ltd., Liverpool branch, has started in business and will trade as O. Beabey & Co., electrical and general engineers, 13-15, Carlton Street, Liverpool. He asks for copies of catalogues.

The London office address of MESSRS. RANSOMES, SIMS AND JEFFERIES, LTD., as from February 7th, will be Dashwood House, 69, Old Broad Street, E.C.2. Telephone No.: "London Wall 2422."

THE WALSALL HARDWARE MANUFACTURING CO., LTD., has opened a new store at 20, New Street, Leicester, where a full range of its conduits, ironclad switchgear, &c., will be stocked. Mr. J. Lea is in charge.

New Catalogues and Lists.

BRITISH ELECTRIC LAMPS, LTD., Spencer Hill Road, Wimbledon, S.W.19.—An illustrated pamphlet advertising "Maxtrip" tubular lamps and a leaflet dealing with candle lamps. Both are priced.

MR. PERCY PITMAN, 25, Victoria Street, S.W.1.—A detailed and illustrated description of the Pitman automatic deflector for the speed regulation of impulse turbines, hydro-electric plant, &c.

MESSRS. J. W. BROOKE & CO., LTD., Adrian Works, Lowestoft.—A folder describing the new "Dominion" 5-7-h.p. motor-boat engine.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Publication No. 305A, illustrating numerous examples of "English Electric" locomotives for industrial purposes. A general description is also included.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Leaflet No. 1061, containing an illustrated description of a 500-W fixed wavelength telephone set for operation by unskilled telephonists.

MESSRS. A. P. LUNDBERG & SONS, 477-489, Liverpool Road, Holloway, N.7.—List S 30, containing illustrated details and prices of plug connectors, adaptors, and accessories.

HIGGS MOTORS, Witton, Birmingham.—An illustrated catalogue of a.c. and d.c. motors for industrial purposes. Full specifications and prices are given.

MESSRS. CROMPTON & CO., LTD., Chelmsford.—List No. A.12, dealing in some detail with "Tru-Wat" three-phase autosynchronous motors for power factor improvement. Fully illustrated.

THE VISCO ENGINEERING CO., LTD., 162, Grosvenor Road, S.W.1.—A brief description of the "Visco" air filter and a list of electricity supply authorities, manufacturers and others who have installed these filters.

MR. J. S. PLUMTREE, 90-91, High Holborn, W.C.1.—A standard list of motors and dynamos made by the Electrical Power Engineering Co. (Birmingham), Ltd.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet O.S.4347, illustrating and describing the floodlighting of the Hearts of Oak Benefit Society building, Euston Road, N.W.1, carried out with G.E.C. projectors, which are also described.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—A coloured illustrated folder advertising the company's gravity conveyors.

THE SUN ELECTRICAL CO., LTD., 118 & 120, Charing Cross Road, W.C.2.—Two illustrated and priced folders dealing, respectively, with domestic appliances and electro-medical apparatus.

MESSRS. VLIES & BENSON, LTD., 1, Brazennose Street, Manchester.—Pamphlet 201A, describing equipotential surface cables made by the Forges et Ateliers de Constructions Electriques de Jeumont.

Bankruptcy Proceedings.

W. H. DICKSON and A. J. SOLOMON, Tavistock Street, Devonport, electrical and radio engineers.—The public examination of these debtors should have taken place at Plymouth Bankruptcy Court on January 28th, but only Dickson put in an appearance, he stating that he had not seen his partner since Christmas. The Official Receiver (Mr. A. N. F. Goodman) said that the business was bought from a man named Kingdon, who absconded, and apparently Solomon had now absconded, while he (the Official Receiver) was the principal creditor by virtue of his position as trustee in the bankruptcy of Kingdon. The statement of affairs showed liabilities of £388, and a deficiency of £270. Dickson stated that in 1925 he answered an advertisement by Kingdon for a partner. The latter wanted him to invest £500 in the business, but he put in £200 only, and became a traveller instead of a partner. Solomon was also employed in the business, and the two of them later took an option to purchase it, each agreeing to find £250. They exercised their option, agreeing to become equal partners, but the only money received by Kingdon was £50 from debtor and £10 from Solomon. Kingdon then became bankrupt and absconded. Subsequently debtor paid the Official Receiver, as trustee in Kingdon's bankruptcy, a further £150. The business was unsuccessful. The case was adjourned until February 25th, the Official Receiver stating that if Solomon did not appear on that date it would be necessary to adjourn the examination *sine die*.

R. P. REEVES, trading as the Luxray Spotlight Projector Co., 5, Say's Corner, North Quay, Great Yarmouth, electrician.—The adjourned public examination of this debtor was fixed to be held recently at the Town Hall, Great Yarmouth, but he did not attend. It was stated that the liabilities amounted to £1,041, and there was a deficiency of £954. The registrar directed that the case should be adjourned with leave to the Official Receiver to apply for a warrant if necessary to secure debtor's attendance.

S. T. HOSKEN, radio accessories manufacturer and factor, 153, Fleet Street, E.C.—This bankrupt, who failed in May, 1925, applied on January 28th to Mr. Registrar Francke for an order of discharge. The Official Receiver reported that the probable debts amounted to £953 and the assets had realised £66. The applicant commenced business in March, 1923, and attributed his insolvency to bad trade, insufficiency of profits to cover expenses and loss in connection with a periodical. The discharge was suspended for one year on statutory grounds.

P. W. HORNE (Horne Bros.), electrical engineer, 260, Linthorpe Road, Middlesbrough.—First and final dividend of 6¼d. in the £, payable February 10th, at the Official Receiver's offices, 80, High Street, Stockton-on-Tees.

J. G. SANDELL, electrical contractor, 20, Hart Road and Ansell Road, Dorking.—First meeting February 9th, at 29, Russell Square, W.C. Public examination February 17th, at the County Court, Croydon.

H. MILNES (H. Milnes & Son), plumber and electrical engineer, 6, Trinity Street, Huddersfield.—Last day for proofs for dividend February 28th. Trustee: Mr. A. Pontefract, 6, New Street, Huddersfield.

A. F. WEBB, electrician, Ashdown, Regents Road, formerly of 102, Duke Street, St. Helens.—Last day for proofs for dividend February 12th. Trustee, Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool.

J. G. SCOTT, electrical engineer, late of 5, Blackwood Place, Leven.—Meeting of creditors at County Buildings, Cupar, February 7th. Agent, Mr. I. W. McInnes.

Company Liquidations.

CLEARTRON RADIO, LTD., wireless manufacturers, London and Birmingham.—A meeting of creditors was held on January 26th, at the Institute of Chartered Accountants, E.C. The chair was occupied by Mr. C. A. Worssam, 9, Bedford Row, W.C., the liquidator in the voluntary liquidation of the company. The chairman read a balance sheet which showed liabilities of £133,700, including share capital £55,000 and debentures £30,000.

The liquidator reported that the company was registered on July 29th, 1925, with a nominal capital of £55,000. The sale and purchase agreement provided mainly for the acquisition of the British and Colonial rights, excluding North and South America, in a valve, and the goodwill and effects of a valve business carried on at Birmingham, whilst there was a factory which was to be equipped for an output of 10 000 valves a week. The consideration payable to the vendor (Mr. Carlisle) was £20,000, payable as to £10 000 in preference shares and £10,000 in cash. The vendor also had an option for the subscription at par of 50,000 deferred shares, which

was exercised, and a further option to subscribe to any fresh capital. It was further provided that there should be a deposit with the company of 10,000 shares in an American concern so that any dividends payable on the stock should be available for Cleartron Radio, Ltd. He understood that the shares were now in the possession of the company. The vendor was to be the managing director for a period of three years. All the shares in the company were subscribed for in cash, except the £10,000 worth allotted to the vendor, with the result that the company received £45,000 in cash. The vendor was apparently liable to equip a factory capable of an output of 10,000 valves a week, but it was not clear whether that was done. At any rate, that number of valves was never produced in any one week. In December, 1925, the company agreed to purchase the European rights in the valve for £20,000. It had paid £11,000 of that amount. Negotiations took place between Mr. Carlisle and the company regarding the claim of £9,000. That claim was to be reduced, but the company was to waive any claim it might have against Mr. Carlisle in respect of any non-equipment of the factory up to the capacity of 10,000 valves a week. The liquidator said he understood that that arrangement was not actually carried out, and there was some doubt as to whether the rights in the valves had been assigned to the company. In addition to the valves, the company entered into agreements for the purpose of acquiring other rights and processes. Last October the company entered into an agreement with another concern to purchase the rights in the "Lodge" set for £6,000. As far as he could gather £1,500 was paid. In May, 1926, the board agreed to the taking over of an additional factory in Birmingham at an estimated cost of £6,500. Presumably something like £4,000 was spent on the factory and equipment, and a deposit of £100 was paid on the land and buildings. In December, 1925, negotiations began with the object of the company being wound up and a fresh company formed with a capital of £50,000, to be later raised to £100 000, but the scheme fell through. The company started to manufacture valves in August, 1925. The sales from that date up to March of last year steadily progressed, but in April, 1926, they fell. In August last the company joined the British Radio Valve Manufacturers' Association, and that involved an increase in the retail prices, and less favourable discounts and terms to dealers and factors, and a royalty of 7 per cent. to the Marconi Company. In November last the company produced a new gasfilled valve, which went very well for a time. Last June the company's account at the bank was overdrawn, and by August £10,000 was owing. An overdraft of £15,000 was then obtained, which was guaranteed by some of the directors. Negotiations were then entered into with another bank, which advanced £30,000 on the security of a debenture over the company's assets. On December 28th last the bank appointed a receiver, and the directors then decided to go into voluntary liquidation.

The chairman agreed that on the figures appearing in the balance sheet there was a total deficiency of £35,000; he did not think that it was as much as £120,000. The unsecured liabilities were £58,000, and there would not be a penny for the unsecured creditors if the assets only realised £20,000, which included an amount of about £12,000 offered for the business. The offer for the business was from one of the guarantors.

Mr. Boult (Messrs. Wake, Wild & Boult) remarked that the most satisfactory way of dealing with the matter would be to present a petition, if any creditor would find the money. It was decided to confirm the voluntary liquidation of the company with Mr. Worssam as liquidator, whilst an advisory committee was also appointed, consisting of the representatives of Messrs. Bertram Day, Ltd., the London Press Exchange, Darling & Son, the Sterling Telephone & Electric Co., Ltd., and Brauen, Ltd. The principal creditors are:—

	£		£
Chloride Electrical Storage Co., Ltd. ...	537	Robinson, E. S. & H., Ltd.	947
Carlisle, A. H.	2 000	Sterling Telephone and Electric Co., Ltd. ...	803
Bertram Day, Ltd. ...	3,800	Darling & Son	645
London Press Exchange	1,902	Brauen, Ltd.	563
Magneto Syndicate, Ltd.	754	Plessy Co.	1,460
Melin & Co.	1,690	Davis & Co.	2,250
		Wolverhampton Box Co.	671

SPANISH & GENERAL WIRELESS TRUST, LTD.—A meeting of members is called for February 28th, at Marconi House, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. S. Pears.

RADIO (HOVE), LTD.—Winding up voluntarily. Liquidator, Mr. A. C. Gillman, 103, Cannon Street, E.C. Meeting of creditors February 15th, at the liquidator's offices. Particulars of claims to the liquidator by February 28th.

The Belgian Telephone Reorganisation.

The *Industrie und Handelszeitung* (Berlin) states, on the authority of a Belgian official announcement, that the programme of reorganisation of the Belgian telegraph and telephone system has been settled in principle. It will take several years to carry out, and details will be made known shortly. In electro-technical circles in Belgium it is reported that it is intended to place contracts for fifty per cent. of the necessary material with German firms on reparation account.

The contracts which are likely to be placed in connection with this reorganisation and the great electrical projects of the French, Soviet-Russian and Turkish Governments have brought forward a suggestion from the United States electrical manufacturing industry that an international arrangement should be made by which this work should be shared. A representative of the Westinghouse Company is said to be visiting Europe in order to approach the French, Belgian, and German groups.

The Swedish Radio Trade.

Statistics forwarded to *Commerce Reports* by an American Consular officer show that during 1925 Sweden imported radio apparatus valued at 4,488,026 crowns, as compared with 2,993,445 cr. in 1924. Germany was the principal supplier (to the extent of 2,440,569 cr.), but Great Britain supplied apparatus to the value of 601,839 cr. During the same year Sweden exported radio goods valued at 439,918 cr. (as against 691,787 cr. in 1925). Norway was the principal customer (88,055 cr.), while Great Britain's share amounted to 13,902 cr.

Hungarian Foreign Electrical Trade.

According to the *Board of Trade Journal*, during the first eleven months of 1926 Hungary imported electrical machines and appliances valued at 7,876,000 gold crowns. During the same period the exports of similar products reached the value of 13,993,000 gold crowns.

Book Notices.

"Circuits for Building Radio Receivers." Pp. 48; illustrated and priced. London: Marconiphone Co., Ltd.—The object of issuing this publication No. 446 is to assist those who derive entertainment from building their own receivers; but no layout suitable for a cabinet has been included, as it is felt that the pleasure of construction is enhanced by the knowledge that the design is original. It is understood that since January 1st, 1927, the company has had 20,000 applications for the booklet, and that two editions have been exhausted; as the demand is still considerable a fifth edition of 10,000 copies has been put in hand—an interesting commentary on the liveliness of the interest taken in the subject at the moment, no less than on the instructiveness of the booklet itself.

"The Director System of Automatic Telephony," by W. E. Hudson. Pp. xi+156; figs. 72. London: Sir Isaac Pitman and Son, Ltd. 5s. net.

"Principles Underlying the Design of Electrical Machinery," by W. I. Slichter. Pp. v+312; figs. 152. Price 18s. 6d. net. "Elements of Heat-Power Engineering," by W. N. Barnard, F. O. Ellenwood, and C. F. Hirshfeld. Part I. "Thermodynamics and Prime Movers." Pp. xii+493; figs. 251. Price 22s. 6d. net. London: Chapman & Hall, Ltd.

"Makers of Science, Electricity and Magnetism," by D. M. Turner. Pp. xv+184; figs. 65. London: Oxford University Press, Humphrey Milford. Price 7s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI. No. 1. January, 1927. New York. Price $1.

"*Journal* of the Institute of Wireless Technology." Vol. I, No. 1. October, 1927. Price 5s.—The first number of this quarterly publication contains extracts from the rules of the Institute and the first membership list (56 names), besides three technical papers. The membership is steadily growing, which indicates that the Institution is proving to be of use.

"Faraday House Journal." Vol. XII, No. 2. Pp. xii+48.—The Lent term issue of this house organ, always of interest and not only to old students, contains an article on "The Existence of a Minimum Sparking Voltage" by the principal; other contributions include "Notes on the Phenomena of Arcing and Switching," by H. Rainford.

"The Elements of Radio-Communication." By O. F. Brown. Pp. viii+216; figs. 146. London: Oxford University Press, H. Milford. Price 10s. 6d. net.

"Circular of the U.S.A. Bureau of Standards," No. 17. "Magnetic Testing" (15 cents).—This publication briefly discusses the quantities and characteristics of magnetic materials and outlines the various methods used by the Bureau for magnetic testing.

"Technologic Papers of the U.S.A. Bureau of Standards," No. 325 (15 cents).—Simplified methods which have been devised for integrating the light output and efficiency curves of lamps derived as a result of the photometric measurements during life are outlined.

"Scientific Papers of the U.S.A. Bureau of Standards," No. 536 (10 cents).—This paper describes the development of a portable radio direction finder with only two controls, balancing and tuning, which operates over the frequency band from 90 to 7,700 kilocycles (3,300 to 39 metres).

An Electricity Committee and Dutch Cables.

At its meeting on January 24th the Salford Electricity Committee adopted a resolution that the whole of its members should visit Holland for the purpose of obtaining particulars as to wages, hours, and conditions of service of craftsmen and general workers in the electric cable-making industry in that country.

The Census of Industry.

It is stated that the work upon the returns sent in for the Census of Industry has been nearly completed by the Board of Trade. The first results are expected to be published in a week or two, and these will be followed by others at short intervals.

A General Utility Machine.

THE GENERAL ELECTRIC CO., LTD., announces that at the forthcoming Ideal Home Exhibition it intends to display an electrically-operated machine which will not only wash and iron clothes, but will mince meat, make sausages, and supply ice-cream, to say nothing of sharpening knives. We await further details with keen curiosity.

New Swiss-Bulgarian Company.

A company has lately been formed in Zurich with a capital of £200,000 and the title La Société pour Entreprises Électriques et Industrielles en Orient, to acquire an interest in the Société Bulgare d'Entreprises Électriques, Sofia, and the collieries at Pirin, Bulgaria.

American Electrical Vehicle Exports.

Only 93 electric motor vehicles, valued at £26,072, were exported from the United States during the eleven months ended with November last, as compared with 114, valued at £35,120, in the corresponding period of 1925.

Electricity in Bulgaria.

According to a recent French official report the electrical trade in Bulgaria dates back only for a few years, except, perhaps, in Sofia. At present, however, it is extending fairly rapidly. Several syndicates have been formed for exploiting the water power of the country, and these are now supplying electricity for lighting and factory use in a number of Bulgarian towns. The electrical equipment of mills and other industrial establishments has led to a considerable advance in the demand for electrical material, none of which is manufactured locally. The trade for the most part is confined to the sale of lighting material, heaters and domestic appliances only being within the scope of the rich families. There is, however, a small scope for hot plates, kettles and irons. The Germans have obtained a firm footing in the market, and have popularised copper or brass finish rather than nickel. Three to six months' credit is usually granted against draft, guaranteed by a bank of standing. The channels of advertisement are chiefly the newspapers and the curtains of theatres, kinemas, &c. Some of the more important rates of Customs duty are as follows:—

Dynamos, motors, transformers, fans, together with spare parts and accessories: (*a*) Above 25 kg. inclusive, 100 gold leva per 100 kg.; (*b*) below 25 kg., free of duty.

Electrical apparatus and spares:—(*a*) Telegraphic and telephonic, 800 leva per 100 kg.; (*b*) meters and measuring instruments, 300 leva per 100 kg.; (*c*) irons, hot plates and heaters, 200 leva per 100 kg.; other heating appliances, 600 leva per 100 kg.

Cables, 60 leva per 100 kg.; wire covered with silk, 200 leva per 100 kg.; wire covered with other textiles, 120 leva per 100 kg.; and wire covered with material other than textiles, 60 leva per 100 kg.

On articles used in electrical installations not elsewhere specified, such as switches, contacts, and sockets, 200 leva per 100 kg. is levied, while ordinary electric lamps pay up to 400 leva per 100 kg. In addition, 20 per cent. of the Customs duties should be added for local duties and about 5 per cent. for other small taxes.

(£1=45 leva, approx.)

Polish Tariff Reduction.

By an order made in February, 1926, and subsequent orders, a reduction of 80 per cent. was made in the duty upon certain machinery and apparatus imported into Poland if such articles were not made in that country. The *Board of Trade Journal* now reports that this concession is to be continued until June 30th next.

The Electrical Contractors' Conference at Scarborough.

In amplification of the announcement made in our last issue we print the following particulars regarding the Second Annual Conference of the E.C.A. Allied Associations which is to be held at Scarborough:—

Wednesday, June 22nd.—Meeting of the Council. Arrival of delegates; reception by the president, Mr. H. J. Miles, and Mrs. Miles; music and dancing.

Thursday, June 23rd.—Welcome by the Mayor; presidential address; annual general meeting; papers and discussions; smoking concert.

Friday, June 24th.—Papers and discussions; address by president-elect; garden party in Peasholm Park; ball.

Saturday, June 25th.—Golf, drives, &c.

The Conference fee will be the same as last year, namely, 25s., and hotel arrangements will follow the same lines. The Conference headquarters will be at the Prince of Wales Hotel, and the Conference meetings will be held at the Olympia, Scarborough. The Conference secretary is Mr. C. V. Fisher (chairman of the E.C.A., Scarborough Branch), 1, Harcourt Place, Scarborough; Conference treasurer, Mr. R. Robson, "Electricity House," Haymarket, Newcastle-upon-Tyne; members of the Conference Committee (in addition to the above), Messrs. E. M. Parsons, 38a, Brook Street, Hull; F. Greathead, 9, Huntriss Row, Scarborough; S. S. Paley, 129, Victoria Road, Scarborough; and J. G. Appleyard, 1, Hanover Road, Scarborough.

Wages in the Contracting Industry.

The National Federated Electrical Association states that in accordance with the existing wages agreements the net hourly rates of wages in the electrical contracting industry, as from the second pay-day in February until the first pay-day in June, will be as follows:—Grade A, 1s. 10½d. (including travelling allowance); Grade B, 1s. 8½d.; Grade C, 1s. 7d.; and Grade D, 1s. 5½d. The new rates represent an increase of ½d. per hour in the cases of Grades A, B and C, and ¼d. in the case of Grade D.

Swedish Electrical Industry in 1926.

A symposium of the views of Norwegian electrical concerns upon the conditions of the past year appeared recently in an official publication. In this the A.S. National Industri refers to the continued depression experienced during the year, stating that the uncertain exchange conditions and the economic difficulties of the public bodies, which form a large section of the company's customers, added to the burden. The efforts of foreign competitors, particularly the Germans, to capture the home market, caused prices to fall to a level just sufficient to meet production costs, and it was impossible to make reasonable provision for depreciation. The prospect for the current year is not viewed with hope, although the currency position has improved. A similar report is made on behalf of the telephone industry by the A.S. Elektrisk Bureau. This company states that the abnormal exchange situation, high taxation, and high wages, placed overhead expenses on too high a level. In spite of that the company was successful in securing two important home orders in the face of external competition. The radio industry, it is stated, placed its expectations from broadcasting on too high a plane, with the result that a number of firms were unable to meet their obligations. With one exception, the broadcasting stations (main and relay) were erected by foreign firms. Further broadcasting developments are expected to improve the business. The home industry has retained the lead in the supply of ordinary receiving sets. The electric heating and cooking apparatus industry is favoured with an extensive home market, and the experience thus gained has enabled Norwegian firms to compete favourably in the foreign field.

The Sydney Plant Contract.

As we have already reported, the Commonwealth Shipping Board has been restrained from manufacturing power plant for the Sydney City Council. The Council has now decided, in view of this, to place the order for mechanical draught plant (valued at £99,698) with the Clyde Engineering Co.

Unemployment in Germany.

The Berlin correspondent of *The Times* says that unemployment in Germany again increased during the first fortnight of the year. On January 15th the number of men and women unemployed was 1,834,000, as compared with 1,747,000 on January 1st.

Scottish Electrical Traders.

A large number of members were present at the annual general meeting of the Scottish Electrical Manufacturers' and Factors' Association, which was held on January 10th, at 13, Dundas Street, Glasgow, in the offices of Messrs. McMillan and Henderson, accountants to the Association. The secretary, Mr. H. C. McMillan, reported that there had been a large increase in membership during the year. The Status Inquiry and Debt Recovery Department had been well supported by the members. The Debt Recovery Department had been most successful, 96 per cent. of the debts handed in for collection having been recovered in full. Owing to the unique method of obtaining and circulating information amongst the members, their losses in insolvencies during the year were greatly reduced as compared with former years. With a view to consolidating the interests of the trade, the meeting recommended the benefits of membership of the Association to all manufacturers and wholesalers in England who were still outside it. Mr. Ames, of the British Electrical and Manufacturing Co., having served his tenure of office as chairman for the year, retired in accordance with the regulations of the Association, and he was heartily thanked for his services. Mr. A. F. Stevenson (the Macintosh Cable Co., Ltd.) and Mr. A. C. Ross (Falk, Stadelmann & Co., Ltd.) were unanimously appointed chairman and vice-chairman, respectively, for the current year. Mr. H. C. McMillan and Mr. P. S. McMillan were reappointed secretary and treasurer, and assistant secretary and treasurer, respectively. Mr. Laidlaw (Andrews & Co.) presided in the absence of Mr. Ames.

Australian Tariff Decisions.

The following classifications have been approved by the Commonwealth Tariff Board:—Tungsten disks and resistance alloys for use in the manufacture of electrical apparatus, Item 404; electrical contact clocks and mercury arc rectifiers (including transformers and switchwear), Item 415A; and remote control switches and switches operated by clockwork mechanism, Item 415A(2).

The Dinner of the Commercial Travellers.

The annual dinner of the Electrical Trades Commercial Travellers' Association is to be held on Friday next, February 11th, at the Holborn Restaurant, W.C., at 7.30 p.m.

New Australian Companies.

Philips Lamps (Australasia), Ltd., was recently registered in Sydney (N.S.W.) with a capital of £50,000, to carry on the business of manufacturers of and dealers in electric lamps, radio apparatus, &c.

Amplion (Aust.), Ltd., has been registered with a capital of £10,000 to carry on business as electricians, manufacturers, &c.

The Telephone Development Association.

The second annual meeting of this Association was held at Aldine House, Bedford Street, W.C.2, on Friday last, Sir Alexander Roger (chairman) presiding. In moving the adoption of the report, the chairman stated that the total revenue for the year under review amounted to £15,962, as compared with £8,964 in the previous year. Seventy-nine per cent. of that amount had been expended in widely differing forms of advertising and propaganda, and 15 per cent. had gone in administration costs. The membership of the Association had increased during the year from 54 to 95; there was, however, still considerable room for development. The direct advertising had produced inquiries respecting the telephone service from 19,200 residents in every corner of the country, and the Association's film had been exhibited at 52 kinema theatres. They had a contract with a company to flash messages every few minutes from an electric screen in Shaftesbury Avenue, and the Association's essay competition had proved very successful. With regard to the future, he felt fully justified in expecting to see a steady volume of orders coming to all, and a distinct acceleration in both the growth of demand and the rate of supply. The report and accounts were adopted, and the chairman, retiring directors, and auditors, were re-elected. At a subsequent extraordinary general meeting a resolution was passed modifying the articles of association, making future meetings yearly instead of half-yearly.

Fire.

Last week a fire broke out at the works of the Premier Electric Control Co., Harrow Road, N.W., causing considerable damage.

A Polyglot Wireless Pamphlet.

British manufacturers are constantly being reminded that printed matter distributed in foreign countries should, as far as possible, be in the languages of those countries. The Brownie Wireless Co. (of Great Britain), Ltd., has made a laudable attempt to meet this requirement in producing a booklet containing instructions for working its "No. 2" receiving set, which is printed in 16 different languages. These comprise not only all the European tongues (including Russian and what looks like Czech), but also Chinese, Japanese, and Arabic. The booklet is one of the most comprehensive in this direction that we have seen.

Unemployment.

There was a further decrease, 41,000, in the number of unemployed during the week ended January 17th. The total at that date was 1,391,000, as compared with 1,432,000 on January 10th, and 1,215,900 on January 18th, 1926.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, February 1st: No change in the prices of electrolytic copper.

Messrs. James & Shakespeare report, February 1st: Copper bars (best selected), sheet and rod, £88, £2 dec.; English pig lead, £28 5s., 5s. inc.

Messrs. Edward Till & Co. report, February 1st: India-rubber, Para fine, 1s. 4d., ¼d. dec.

Messrs. James Forster & Co., reporting on January 29th, stated:—"Closing prices yesterday were £26 16s. 3d. for January, and £27 2s. 6d. for April, against £27 7s. 6d. and £27 12s. 6d., respectively, at the end of last week. A flat tone was in evidence on Monday, when prices fell 10s. a ton, while a further 8s. 9d. was lost on Tuesday. There was then a rally of 7s. 6d. a ton. The general position is unchanged, with supplies ample and only a moderate demand. As far as the market is concerned the position is healthier. Realisation of speculative commitments has continued, and a short account been opened which will add strength to the market later on. This week's fall in values seems to be due more to sympathy with the weakness in other metals than to any change for the worse in the position, which, in fact, is improving. Stocks in this country are probably not more than 10,000 tons, which is only about a fortnight's normal supply."

Accumulator Makers' Association.

The annual dinner of this Association is to be held at the Savoy Hotel on Monday, February 21st, at 7 p.m. Mr. B. M. Drake, M.I.E.E., will preside.

Conditions in Brazil.

Commerce Reports states that Brazilian trade prospects have been improved by the projected stabilisation of the milreis at $0.125 and the subsequent adoption of a new currency unit, the "cruzeiro" (about four milreis). Transactions in electrical goods have recently indicated considerable improvement both as regards direct importations and sales from stocks. Two American companies have been awarded contracts for the electrification of the Paulista Railways. The radio business is said to be dull in Rio de Janeiro, but satisfactory in Sao Paulo.

The E.D.A. Annual Dinner.

The annual dinner of the British Electrical Development Association is to be held at the Savoy Hotel, London, on Thursday, March 17th. Tickets are 25s. each.

Opposition to Municipal Trading at Leeds.

The President of the Leeds Chamber of Commerce (Mr. J. R. Portway), who was re-elected last week for another year of office, expressed opposition to the Corporation's proposed extensive scheme of wiring houses and selling electrical fittings. He condemned the proposal as undesirable municipal trading, and hoped it would be strongly opposed in the city.

Lighting and Power Notes.

Australia.—CAIRNS (Q.).—According to *Tenders*, the Cairns Hydro-electric Board has received a report by Mr. P. A. W. Anthony in which he recommends the harnessing of the Barron Falls without delay. The cost of power plant is estimated at £180,000; transmission line and reservoir, £19,500; and line to Cairns, £3,000, making a total of £202,500.

Braintree.—POWER STATION BREAKDOWN.—The electricity supply for the town failed during a thunderstorm on January 27th. It was ascertained later that the power-station at Messrs. Lake & Elliott's, which supplies the town, had been struck and the plant temporarily put out of action. The fault was remedied during the day, and no great damage appears to have resulted.

Brightlingsea.—ELECTRICITY IN BULK.—The Urban District Council has decided to ask the County of London Electric Supply Co., Ltd., the East Anglian Electric Supply Co., Ltd., and the Colchester Corporation by what time they will be in a position to give a supply of electricity in bulk, and upon what terms.

Brighton.—LOANS.—The Corporation Electricity Committee is making application for sanction to loans to defray the cost of the following works:—One 6 000-kW turbo-alternator and accessories, £39,360; new reinforced concrete roadway, £5,000; steam turbine rotary feed pumps, £400; water softening plant, £962; 1,000-kW motor convertor, North Road, £10,220; extension of boiler plant and buildings, £64,966; switchgear for supply to Portslade, Southwick, and Shoreham, £690.

Continental.—NORWAY.—The budget proposals of the Government Water Power Department for 1927-28 contain a survey of the works carried out and still to be executed in connection with the State hydro-electric works which are being established on the Nore. The works are to be ready to supply electricity by July, 1928, and a sum of over 48,000,000 kr. has already been granted for the purpose. Contracts have been entered into for the delivery of 43,000 kW, and it is anticipated that the demand will reach 55,000 kW by the time the works are in operation. Consideration is now being given to possible extensions in the event of the demand further increasing.

AUSTRIA.—The Styrian Water Power and Electricity Co., of Gratz, has issued its report for 1925, in which it states that during the twelve months the main constructional work which has occupied nearly five years has been completed. The Teigit hydro-electric station and the long-distance transmission line to Gratz and the Gratz-Sud transformer station have been put into operation. The 60,000/100,000-V transmission line from Gratz to the North and the Murzzuschlag transformer station was put into operation early in 1926. During the year about 112 miles of 20,000-V transmission lines were erected in West, East and Northern Styria.

Coventry.—OPPOSITION TO ORDER.—The City Council has decided to oppose the application of the Leicestershire and Warwickshire Electric Power Co. for a Special Order authorising it to supply electricity in a large area in central Warwickshire, including parishes which the Corporation is seeking to include within its area.

Croydon.—CHANGE-OVER.—Having discussed with the Electricity Commissioners the question of alteration of the pressure of supply, the Corporation Electricity Committee has decided to seek an Order to enable it to change over the supply to consumers to 230 V as and when convenient.

WIRING OF SMALL HOUSES.—The Committee is preparing a scheme for the provision of electrical installations on the hire-purchase system, the work to be done by local contractors, and a sum of £10,000 is being allocated for this purpose.

LOAN.—Application is being made for sanction to a loan of £23,000 for electricity purposes.

Dunfermline.—GALE DAMAGE.—Serious damage was caused by the gale at the generating station of the Fife Electric Power Company, on January 28th, when two of the cooling towers fell and were completely wrecked. The staff was able to maintain a supply of electricity.

Eastbourne.—LOAN.—The Town Council on January 19th decided to apply for a Special Order to supply electricity to the parishes of Pevensey, Westham, and Hailsham. The estimated capital expenditure is £54,000.

Epsom.—LOANS SANCTIONED.—The Urban District Council has received sanction to the borrowing of £2,000 for wiring installations, and £2,000 for domestic apparatus to be let out on hire.

Falkirk.—ELECTRICAL DEVELOPMENT.—The burgh electrical engineer reports that in 1926 the number of new consumers connected up was 339, and that the maximum demand during December was 2,800 kW, which was carried by the 3,000-kW set. At the present rate of expansion, by the winter of 1928 additional generating plant will be required, and it will be necessary to make provision for future requirements. A sub-committee has been appointed to take up the matter with the Electricity Commissioners.

Frickley (Yorks.).—COLLIERY POWER PLANT.—The *Manchester Guardian* states that the Carlton Main Colliery Co. has completed an electrical power plant costing £200,000. Four villages and three thousand houses will be supplied with electricity for lighting, householders being charged a flat rate allowing of unlimited consumption with a certain number of lights.

Glasgow.—ELECTRICAL DEVELOPMENT.—The number of houses wired in November last under the Corporation Electricity Department scheme was 155, and appliances let out on hire 888. For December the figures were 124 and 499, bringing the respective totals up to 3,130 and 14,028.

Grays.—LOAN.—The Urban District Council has applied for sanction to a loan of £4,000 for the purchase of a 750-kW rotary-convertor and transformer.

FRINGE ORDER.—The Council has consented to the application of the County of London Electric Supply Co., Ltd., for a fringe Order to supply electricity to a new cement factory in the district. The company will pay £200 per annum provided the Order remains in force for 15 years.

Hornsey.—LOANS.—The Electricity Committee is applying for sanction to loans of £20,000 for mains and £10,000 for services.

Horsham.—ELECTRICAL DEVELOPMENT.—The Lighting Committee has received a report from the electrical engineer with regard to the extension of the Urban District Council's area of electricity supply, in which he states that the electrical requirements are outgrowing the present plant and system. He has suggested that the first consideration should be the complete reorganisation of the power station and the introduction of the a.c. system. Considerable capital expenditure would be involved, and for this reason he is of opinion that the services of an independent expert are desirable. The Committee has decided that Mr. W. M. Selvey, consulting engineer, be invited to report to the Council on the whole matter.

Ilford.—LOAN SANCTIONED.—The Electricity Committee has received sanction to a loan of £5,000 for the purchase of domestic apparatus to be let out on hire.

ELECTRICAL PROGRESS.—The borough electrical engineer reports a steady increase in the hiring of installations, apparatus, &c. Hire agreements now number 4,754, and represent an additional installed load of about 8,000 kW.

India.—CALCUTTA.—According to the *Indian Engineer*, a supply of electricity from the new generating station of the Calcutta Electric Supply Corporation was given to Calcutta on December 22nd. This supply was given from the first of the three turbines to be started up. The other two sets already installed will be brought into commission as soon as they pass their tests. The new station is designed for an ultimate capacity of 150,000 kW, and there are installed there at present three sets, with a continuous rating of 7,500 kVA. each with the necessary boilers and auxiliary plant. This station is interconnected with the power station at Cossipore, the total capacity of installed plant in the two stations being 75,500 kW. The maximum load on the system up to the present time is 37,200 kW. In order to meet the constant demands for electricity, another 6,000-kW set has already been ordered for the southern station, which is expected to be in commission before the end of this year. Further additions are already under consideration for increasing the plant at both stations to meet the expected winter demands for 1928.

Irish Free State.—LIMERICK.—Dr. Sothman, technical engineering adviser to the Free State Government on the Shannon scheme, recently attended a meeting of the Corporation Electric Lighting Committee with reference to the question of a supplementary supply of electricity from Messrs. Siemens-Schuckert's power station at Ardnacrusha. He gave a brief outline of the scheme, and explained the system of overhead transmission cables. It is understood that when the way-leave agreements have been completed the work of the erection of standards to carry the transmission lines will be undertaken.

Lexden and Winstree.—OPPOSITION TO SCHEME.—The Rural District Council is to oppose the application of Colchester Town Council for a Special Order to supply electricity in the district on the ground that only Dedham and a portion of Stanway are included in the proposals for the first two years. It is also considered that the maximum price, 11d. per kWh. is excessive.

Lincoln.—ELECTRICITY SCHEME.—The Corporation Electricity Committee proposes to supply electricity in the south-west part of the town, which includes Moorland Park Estate, Swanpool, &c., the estimated cost of the scheme being £40,000.

Liverpool.—ELECTRICITY SUPPLY.—Mains are to be laid by the Corporation to the housing estates at Crosby on similar terms to those for the Liverpool housing estates. Negotiations are proceeding for a bulk supply to Maghull.

Maidstone.—ELECTRICITY SUPPLY.—The Rural District Council has decided to support the application of the Weald Electricity Supply Co., Ltd., for power to supply in part of the Council's area, provided that Hunton, as well as Staplehurst, Marden, and Yalding, are included in the Order.

Mansfield.—ELECTRICITY IN BULK.—As a result of the experimental running of the bulk supply of electricity from the Derbyshire and Notts. Electric Power Company, the Electricity Committee has recommended that the Council take the supply under the terms of an agreement already drawn up. It has been decided that the present plant shall be kept in commission and sufficient staff retained for the purposes of giving a supplementary supply.

Newcastle-on-Tyne.—PROGRESS OF SUPPLY.—During the last 12 months 12,000 consumers have taken advantage of the Newcastle-upon-Tyne Electric Supply Co.'s hired wiring scheme for dwelling houses. Many villages are being supplied with electricity under this scheme and at Shildon nine hundred slot meters have been installed since last March. The company intends to survey and canvass the West Auckland district with a view to providing a supply, and the Parish Council has promised its support.

Ollerton.—STREET LIGHTING.—The Parish Council has accepted the offer of the Butterly Colliery Co. for electric street lighting at £4 per lamp per annum, including maintenance.

Pembrokeshire.—PROPOSED HYDRO-ELECTRIC SCHEME.—The Works Committee of the County Council has recommended approaching the Government to consider a scheme for the construction of a barrage across the upper end of Milford Haven with the object of supplying electricity to the surrounding country.

Port Bannatyne.—INAUGURATION OF SUPPLY.—An electricity supply for the district was formally inaugurated by the vice-chairman of Bute County Council on January 21st.

Seaham Harbour.—SPECIAL ORDER.—The Ministry of Transport has confirmed the Urban District Council's Special Order, but with the addition of the "Northumberland" clause, which was asked for by the Seaham Harbour Gas Company. Under the "Northumberland" clause the Council is prohibited from drawing from the rates to meet any loss that might be incurred in the conduct of the proposed electricity undertaking.

Scunthorpe.—H.P. CABLES.—The Urban District Council is to duplicate the h.p. cables at a cost of £2,842.

Shipley.—CHANGE-OVER.—The Electricity Committee is to change over the supply of electricity in the Redburn district from d.c. to a.c. and erect a sub-station at Northcliff Woods at a total cost of £1,900.

South Africa.—JOHANNESBURG.—The Town Council has decided to ask the Victoria Falls and Transvaal Power Co., Ltd., whether and at what time it will provide a partial supply of electricity to supplement the Council's own supply. The resolution has followed protracted negotiations with the Electricity Supply Commission, which some time ago reported against the Town Council's application to the Administrator for permission to erect a new power station at a cost of £500,000.

Southport.—ELECTRICITY EXTENSIONS.—Following an interview by the borough electrical engineer with the Electricity Commissioners regarding the Council's application for sanction to borrow £35,000 for electricity extensions, the Commissioners have intimated that the extension of the mains can be proceeded with, and that the requisite sanction will be given at an early date. With regard to the extension of plant, the Commissioners intimated that the Council should apply to Preston and Liverpool Corporations for their terms for giving a bulk supply, and if such a supply could be obtained on more economical terms then the Commissioners would not sanction any extension of plant. In the event of Preston and Liverpool being unable to give a bulk supply on economical terms, the Commissioners requested the electrical engineer to communicate with them again.

Special Orders.—Applications have been made to the Electricity Commissioners for a Special Order by Watford Corporation authorising it to supply electricity in certain parishes in the rural districts of Berkhamstead and Hemel Hempstead.

The Commissioners have submitted to the Minister of Transport for confirmation, a Special Order made by them authorising the Lancashire Electric Power Co. to supply electricity within the rural district of Leigh.

Stourport.—NEW POWER STATION.—Work on the new power station which has been erected by the Shropshire, Worcestershire and Staffordshire Electric Power Co. is now practically completed, and the plant is now undergoing extensive trial runs. The erection of overhead lines has been put in hand, and work is proceeding on a line to Tewkesbury, where several local industries are waiting for a supply. The new station is to be connected with the Birmingham Electricity Depart-

ment's service in order to cope with the increasing demand which is anticipated before the station which the Corporation is to erect at Hams Hall will be ready for service.

Tendring.—OPPOSITION TO ORDER.—At a meeting of the Rural District Council, on January 26th, it was decided to oppose the application of Colchester Town Council for a Special Order to extend its area of electricity supply on the following grounds:—(1) That the maximum price is excessive; (2) that the promoters do not propose to cover an adequate and reasonable area of supply within the first two years; (3) that the Colchester plant will not be ready to afford a supply for some considerable time; and (4) that by granting the Order, the Electricity Commissioners will be giving a monopoly of supply which might prove detrimental to the district, and prevent, or postpone, a supply being afforded by some other undertakers.

Tynemouth.—LOAN.—The borough electrical engineer (Mr. C. Turnbull) has submitted a report to the Electricity Committee in which he states that considerable developments are anticipated during the coming year. He has therefore recommended that application be made for sanction to a loan of £30,600 for the following purposes:—Sub-station at Cullercoats, £2,000; extension of Preston Village sub-station, £800; sub-station at Dock Road, North Shields, £1,700; supply to Commissioners' docks, £8,300; five transformers, £1,800; and cable extensions, £16,000.

Tramway and Railway Notes.

Bradford.—OPPOSITION TO BILL.—Wharfedale Rural District Council has decided to oppose the Corporation's Transport Bill, which includes a service along roads in the rural area which are considered unsuitable for such traffic.

PROPOSED ABANDONMENT OF TRAMWAY.—Councillor J. A. Guy has given notice to move at the City Council meeting on February 8th, that the Corporation's decision to renew the tramway track in Barkerend Road at an estimated cost of £23,000, be rescinded, and that the trams to Bradford Moor be replaced by a motor-'bus service.

Continental.—ITALY.—At a recent railway conference, held in Padua, it was announced that the Italian State Railway authorities had decided to commence the work of electrifying the railway between Bozen and the Brenner frontier early next year.

SWITZERLAND.—Good progress is being made with the electrification of the Winterthur-St. Gall-Rorschach section of the Swiss Federal Railways, and it is expected that it will be in operation by May next.

Edinburgh.—TRAMWAY EXTENSIONS.—A sub-committee of the Tramways Committee has recommended that steps be taken to obtain the necessary powers to extend the tramway to Farmilehead by Stenhouse Mills, Gorgie.

Increase of Charges.—The Minister of Transport has made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act., 1918, authorising certain fare charges by the following tramway and light railway authorities:—The Urban Electric Supply Co., on its Camborne and Redruth, and Glossop Tramways, the Worcester Electric Traction Co., Ltd., the Bristol Tramways & Carriage Co., Ltd., South Lancashire Tramways Co., Swansea Improvements & Tramways Co., the Great Orme Tramways Co., Rawtenstall Corporation, and the Bexley and Dartford Urban District Councils.

Japan.—PROPOSED ELECTRIC RAILWAY.—It is reported that an electric railway from Inariyama station on the Government Central Line to Yawata is proposed. The chief promoter is Mr. S. Kamijo, member of the Nagano Prefectural Assembly.

London.—MORDEN STATION GARAGE.—The new garage at Morden station, the first of its kind in this country, has been completed, and was opened for business on January 31st. It has an area of 7,600 sq. ft., and will provide accommodation for 200 cars and cycles. Although it is intended primarily for the convenience of Underground passengers, it will be at the disposal of local residents. If the experiment is successful, it is probable that similar garages will be erected at other outlying terminal Underground stations.

Worcester.—PROPOSED ABANDONMENT OF TRAMWAY.—The *Birmingham Post* states that the Public Traffic Committee of the City Council has prepared a report which will be considered by the City Council in which it recommends, after the lease expires, the scrapping of the present tramway system, the removal of the track, and road reinstatement at a cost of £75,000. The Committee states that provisional terms have been arranged with the Birmingham and Midland Omnibus Co. to run an omnibus service in the city in substitution of the trams and a service to areas on the borders of the city. The committee considers that this method of transport is preferable to the Corporation's incurring a large outlay in acquiring omnibuses and garage accommodation of its own. It is suggested that an agreement should continue for 21 years.

Telegraph and Telephone Notes.

Australia.—"BEAM" RADIO-TELEGRAPHY.—Marconi's Wireless Telegraph Co., Ltd., has issued the following statement with regard to the "beam" radio-telegraph stations it has built on behalf of the British Post Office for communication between England and Australia, official seven days tests of which were recently carried out:—

"The tests . . . have demonstrated that the wireless link between the beam stations in England and Australia is capable of working at high speed each way for more hours than are called for in the terms of the contract with the Post Office, but defects developed during the tests on some of the auxiliary apparatus. The company has informed the Post Office that it requires further time to correct these defects, and it is therefore not applying to the Post Office to accept the stations until such defects are remedied."

Belgium.—REORGANISATION.—The Belgian telephone and telegraph reorganisation programme has been completed in its main lines and will extend over several years. It is expected in the Belgian electrical industry that half of the orders for the supply of material will be placed with German firms on reparations account. Government circles have suggested to the Belgian electrical industry the conclusion of a working agreement with German, and eventually other foreign, electrical undertakings for the reorganisation of the systems. The cost is estimated at 12,000,000 fr.—*Reuter's Trade Service* (Berlin).

Persia.—NEW RADIO SERVICE.—A general local and foreign wireless service was established at Teheran on January 28th for the first time.—*Reuter's* (Teheran).

The Telephone Service.—YORKSHIRE DEVELOPMENT.—We have received from Mr. T. B. Johnson, M.I.E.E., superintending engineer, North-Eastern District, Post Office Engineering Department, a copy of the annual report to the Telephone Advisory Committee, which shows that, in spite of industrial unrest, marked advance was made in all directions in 1926. New lines connected totalled 4,722, a net increase of 2,298, or 6 per cent.; the total number of lines was 38,119 on September 30h, 1926. In the Leeds area the satellite exchanges of Chapeltown, Headingley, Roundhay, and Stanningley have been converted from magneto to automatic working; at Halifax an automatic exchange, it is hoped, will be completed early this year, and at Wakefield the installation of automatic equipment is in hand. The Brighouse exchange is to be converted from magneto to central-battery working and transferred to new premises; at Dudley Hill and Low Moor new c.b. exchanges are in course of construction. At Keighley, Armley, and Sandal, and other places building has commenced for housing new automatic exchanges, and at a number of existing exchanges additional switchboard equipment has been installed. A rural exchange has been opened at Cracoe.

Considerable progress has been made in the provision of public kiosks throughout the district; there are over 200 actually available or on the point of completion. It is the intention to introduce in the near future "Hall multi-coin" boxes at kiosks and call offices connected to the larger exchanges. Calls effected during the year were as follows:—Trunk calls, 5,231,959; local and junction calls, 38,208,568; telegrams passed by subscribers by means of the telephone, 388,825. The value of private automatic exchange switchboards at subscribers' premises is being increasingly recognised.

During the year satisfactory progress has been made with the laying of trunk and local underground cables; the gross mileage of wire existing at the end of September was 202,895 miles, an increase of 22,184 miles.

The closing down of the generating station at the Leeds Head Post Office has been completed, and electric light and power are now obtained from the Leeds Corporation electricity works; the annual consumption is about 360,000 kWh. At the Leeds Head Post Office alterations have been carried out to provide room for a new repeater station to work in connection with the underground cable from London to Glasgow; the temporary station has a capacity of 43 repeaters, 35 of which are working, but the ultimate capacity will be approximately 1,000 repeaters.

NEW EXCHANGES.—At Lytham-St. Annes, on January 13th, a new telephone exchange was opened at the Post Office. The local Shipley exchange was transferred on January 15th from the old quarters at Saltaire Road to a new building of the Post Office in Otley Road.

The following are among the telephone exchanges completed by Siemens Brothers & Co., Ltd., Woolwich, during 1926:—

Automatic: Chesterfield, Edinburgh area (four exchanges), East Hartlepool, West Hartlepool, Morriston, Stavely, and Albion exchanges; Newmarket (Australia), Winnipeg West (Canada), Stratford (New Zealand), Cairo (Egypt), Port Elizabeth extension (South Africa), Baku (Russia), and also extensions to Grimsby, Swansea, and Sketty.

Manual: Bexley Heath, Camberley, Dumfries, Popesgrove, Seven Kings, Shipley, and Southend.

Radio Notes.

Australia. — ROYAL COMMISSION. — The Commonwealth Government has decided to appoint a Royal Commission of Inquiry in Australia. In making the announcement, the acting Prime Minister said the question had been for some time engaging the attention of the Federal Government. The *personnel* of the Commission, which will be composed of experts, has not yet been announced; it will consider broadcasting within the Commonwealth, and will examine alterations suggested as desirable in policy and practice. The Postmaster-General said that the Government was following the steps of Great Britain, though on a smaller scale, as the Australian Commission would consist of only three members; everything, including a suggestion of Government control of broadcasting stations, would be determined according to the findings of the Commission.

EXHIBITION.—Such was the success of the radio exhibition held in Melbourne last year that it has been decided to hold another about next March or April. Larger accommodation has been secured in the Exhibition Building, Melbourne, and all interested in wireless are giving enthusiastic support.

RELAY STATIONS.—Following the successful practice in Great Britain, the Melbourne broadcasting station (3 LO) is to erect relaying inland stations at three different centres, probably at Ballarat, Bendigo, and Sale, or Bairnsdale. One station will be provided in Gippsland, as there is a large population to be served in that area, and observations have shown that fading is worst there. The power used will probably be half that of 3 LO, which works on five kilowatts. —*Reuter's Trade Service* (Melbourne).

Finland.—NEW STATION.—The wave-length chosen for the projected 25-kW station is 1,500 metres, and the Union Internationale de Radiophonie, Geneva, has drawn attention to possible difficulties on account of the fact that the Moscow station uses 1.450 m.

Haiti.—Since the commencement of broadcasting in August, 1926, the station at Haiti (call sign HHK), has received a large number of complimentary communications from listeners. It is a 1-kW station operating on a wave-length of 361.2 metres, and financial support is obtained by the Government in the form of appropriations to the Department of Public Works. Atmospherics give very little trouble in Haiti, and in winter are almost unknown, so that from November to March the reception of foreign stations is admirable. Station HHK is of "Western Electric" design, and was installed by the International Standard Electric Corporation.

Hungary.—NEW STATION.—The Government has just substituted a 3-kW transmitter for the 2-kW plant on Csepel Island, says *World Radio*, and is also contemplating the erection of a 60-kW transmitter.

Japan.—NEW STATION.—An order is said to have been placed for a 600-kW station, which will be ready in 1928, says *Eastern Engineering*. It is to be entirely the property of the Japanese Wireless Telegraph Co., an official concern enjoying the support of Parliament.

New Daventry Station.—SHORT-WAVE PLANT.—A new station at Daventry, which is to operate at high power on a short wave-length, is being installed by the B.B.C. It is intended to supply an alternative service for users of crystal sets, and will utilise a power equivalent to that of 5XX. The masts are to be only 100 ft. high, and are to be built in sections, so as to facilitate their removal to another site if it is found to be desirable to do so. Experimental transmissions, which will be conducted out of the regular broadcast hours, are likely to begin in a few days' time.

South Africa.—STATE CONTROL PROBABLE.—The Johannesburg broadcasting company has received the following telegram from Mr. Madeley, the Minister of Posts and Telegraphs:—"The general tendency in broadcasting is increasingly in the direction of public control. A private profit-making control would be a retrogressive step. I cannot therefore agree to sanction the transfer of the licence." This is regarded as an indication that the Government intends to take over control of broadcasting, says *The Times*, which has reason to believe that State control will be generally welcomed in the Transvaal, and the Free State and Durban will probably fall in willingly with the proposal. Cape Town may raise objections, but the Government will be able to assume control when the present licence expires.

Wave-lengths.—CORRECTION.—In the list of new wave-lengths published last week it was stated that the Hull, Stoke, Dundee, and Swansea stations' wave-length was 249 metres; this figure is incorrect, as the stations named are now working on a common wave-length of 294 metres. We regret the transposition of the figures.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Armthorpe (Yorkshire).—February 15th. Education Department. Electric lighting installation at new school. Education Committee, West Riding County Hall, Wakefield.

Argentina.—BUENOS AIRES.—March 24th. Department of Navigation and Ports. Electric cranes, pumps, &c. (A.X. 4087).*

Australia.—MELBOURNE.—March 8th. Postmaster-General's Department. Accumulators and plates. (B.X. 3170)*; motor-generator sets. (B.X. 3172.)*

April 5th. Cordless switchboards. (B.X. 3184.)*

SYDNEY.—March 9th. New South Wales State Railways. Two sets of electric overhead travelling crane equipments. (A.X. 4103.)*

April 6th. One 7,500-kW turbo-alternator. (B.X. 3179.)*

Belfast.—February 5th. Electricity Department. One induction motor-driven vertical-type centrifugal pump. (January 21st.)

February 18th. Electricity Department. Twelve months' supply of materials, including electrical accessories, lamps, carbon brushes, cables, &c. (January 28th.)

February 8th. L.M. & S. Railway, Northern Counties Committee (Ireland). Twelve months' supply telegraph ironwork, wire, electric lamps, porous pots, &c. Mr. F. J. Martin, Stores Superintendent, York Road Station, Belfast.

Bexley.—Electricity and Tramways Department. One 1,400-kVA bank of Scott-connected transformers. Two 140-kVA single-phase induction regulators, e.h.p. and h.p. switchgear and cable connections. (See this issue.)

Bristol.—February 18th. Electricity Committee. Coal- and ash-handling plant, and railway sidings; circulating-water screening plant. (January 28th.)

Canterbury.—February 21st. Electricity Department. L.p. lead-covered and armoured feeder cables. (See this issue.)

Cardiff. — February 23rd. Electricity Department. Twelve months' supply paper-insulated cables. (See this issue.)

Croydon.—March 3rd. Electricity Department. 12,000 tons of coal suitable for use on chain-grate mechanical stokers. (See this issue.)

Douglas.—February 28th. Corporation. 3½ miles of e.h.p. cable, two synchronous motor alternators. (January 21st.)

Dundee.—February 21st. Electricity Department. Two water-tube boilers with superheaters, economisers, mechanical stokers, and coal-handling plant. (January 28th.)

Eastbourne.—February 21st. Electricity Department. E.h.p. cable, static transformers, and e.h.p. switchgear. (January 28th.)

Eccles.—February 12th. Electricity Department. Two 500-kVA, 3-phase oil-cooled transformers. Borough Electrical Engineer, Cawdor Street, Patricroft.

Egypt.—CAIRO.—March 3rd. Ministry of Public Works. Two internal-combustion engines and accessories for the Egyptian Army Flour Mills, Tura, near Cairo. (A.X. 4187.)*

Harrogate.—February 28th. Electric lighting installation for St. Mark's Church, Leeds Road. Particulars from the Verger.

Huddersfield.—February 19th. Town Council. Electrician's work at maternity home, Greenhead Road. Borough Architect, 26, Ramsden Street.

Hull.—February 14th. Tramways Committee. Stores for 12 months, including car-lighting fittings, lamps, cable and switches, &c. General manager.

Inverlochy.—February 5th. Village Society, Ltd. Electrical installations in 100 houses. Messrs. Matheson and Mackenzie, surveyors, 197, St. Vincent Street, Glasgow.

Leeds.—February 18th. Electricity Department. Twelve months' supply of stores, including cables, boxes and fittings, jointing and insulating materials, &c. (January 28th.)

London.—HAMMERSMITH.—February 16th. Electricity Department. Twelve months' supply of stores, including several electrical items. (January 21st.)

SHOREDITCH.—February 23rd. Electricity Department. One 1,500-kW automatic sub-station converting equipment and one 20-ton electrically-operated overhead travelling crane. (January 28th.)

LONDON COUNTY COUNCIL.—February 14th. Electrical installation at the undermentioned schools:—Barrett Street Trade School Extension, Oxford Street, W., lighting, power, telephones, bells, &c.; County Secondary School, Eltham, S.E., lighting, power, telephones and bells; Crondall Street Elementary School, Shoreditch, lighting; Drayton Park Elementary School, Islington, lighting. (See this issue.)

H.M. OFFICE OF WORKS.—February 17th. Electrical accessories. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—February 23rd. Carrying out the installation of electric lighting at Millfield, Rustington, near Littlehampton, Sussex. (See this issue.)

Long Eaton.—February 24th. Electricity Department. One 500-kW convertor set and one switchboard platform. (See this issue.)

Manchester.—February 15th. Tramways Committee. General stores, including electrical materials, &c. Mr. H. Mattinson, general manager.

New Zealand.—AUCKLAND.—March 22nd. Harbour Board. Electric motors, gearing, shafting, and control gear for the operation of vehicular and passenger gangways at the New Devonport Ferry Wharf. (A.X. 4102.)*

WELLINGTON.—March 4th. Poverty Bay Electric Power Board. Switchgear and transformers. (B.X. 3160.)*

April 26th. Public Works Department. Secondary battery for the Lake Coleridge scheme. (B.X. 3202.)*

Peterborough.—February 28th. Electricity Department. One 12,000-kW turbo-generator, with foundations, condensers, air and extraction pumps, air cooler, oil cooler and pipework, e.h.p. switchgear, coal-handling plant, &c. (January 28th.)

Portsmouth.—Electricity Department. Coal-handling plant. (January 28th.)

Spalding.—February 26th. Urban District Council. 28 sets of centrifugal pumps (for sewage pumping), including electric motors, automatic starters, floats, valves, pipes, &c. Mr. C. F. Murphy, Lloyd's Bank Chambers, Morpeth.

Stoke-on-Trent.—February 9th. Electricity Department. Static transformers, sub-station switchgear. (January 28th.)

Tilbury.—February 12th. Urban District Council. H.p. underground cables, l.p. distribution mains, house services, transformers, h.p. and l.p. switchgear and conversion of public street lamps. (January 28th.)

Torquay.—Electricity Department. Two vertical circulating-water pumps for Newton Abbot power station. (January 21st.)

Tynemouth.—Tynemouth Gas Co. 70-h.p. electric motor at gasworks.

Uruguay.—MONTEVIDEO.—March 2nd. State Electricity Works. Lead fuse wire, silver fuse wire, switches, cable end boxes, compound and insulating tape. (B.X. 3159.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia. — VICTORIA.—Postmaster-General's Department. Switchboard and instrument jacks (Sch. C.80).—British General Electric Co., Ltd. (£490); New Systems Telephones Pty., Ltd. (£845); Phœnix Tel. & Elec. Works, Ltd. (£539).

Telephones and dials (Sch. C.105).—Phœnix Tel. and Elec. Works, Ltd. (£2,956); Ericsson Tel. Mfg. Co., Ltd. (£65,277); Siemens (Aust.), Ltd. (£17,003); British General Electric Co., Ltd. (£9,881); New Systems Telephones Pty., Ltd. (£1,012); Automatic Telephone, Ltd. (£15,783).

NEW SOUTH WALES.—Government Railways.

Storage battery for Randwick sub-station (£3,110).—Tudor Accumulator Co., Ltd.

—*TENDERS.*

Guildford.—Sewage Committee. Accepted:—

Pumping plant, &c., at Drummond Road pumping station (£650).—Worthington-Simpson, Ltd.

Hornsey.—Lighting Committee. Recommended:—

Electric lighting installation at 121 Council houses.—E. Wright & Co.

Hull.—Telephone Committee. Accepted:—

Wires and cables (£230).—General Electric Co., Ltd.

LONDON & NORTH-EASTERN RAILWAY.

Four electrically-driven hydraulic pressure pumps for pumping station, Hull.—Pulsometer Engineering Co.

Ilford.—Electricity Committee. Accepted:—

Cable (£2,385).—Union Cable Co., Ltd.

One e.h.p. feeder cubicle (£235).—Crompton & Co., Ltd.

Cable (£709).—Power and Lighting Cables, Ltd.

Irish Free State.—DUBLIN.—Dublin United Tramways Co., Ltd.

12 months' supply of Siemens vacuum lamps.—Siemens and English Electric Lamp Co., Ltd.

Leeds.—Tramways Committee. Accepted:—

Rail clips and bolts (£212).—Bayliss, Jones & Bayliss, Ltd.

Cables.—Greenwich Cable Works, Ltd., and W. T. Glover and Co., Ltd.

London.—BATTERSEA.—Electricity Committee. Accepted:—

Electric lift (£674).—Express Lift Co., Ltd.

ADMIRALTY.—Accepted:—

"Cosmos" flashlight lamps.—Metro-Vick Supplies, Ltd.

GREAT WESTERN RAILWAY CO.

Twelve months' supply of vacuum lamps.—Omega Lamp-works, Ltd.

LONDON COUNTY COUNCIL.—Highways Committee. Accepted:—

Four diaphragms for Westinghouse 8,000-kW turbine at Greenwich power station.—Metropolitan-Vickers Electrical Co., Ltd.

Steel bars (£1,100).—Lillieshall & Co., Ltd.

Gear wheels and pinions (£745).—Equipment & Engineering Co.

Steel axle bars (£835).—Steel, Peech & Tozer, Ltd.

Eight motors as spares (£2,140).—Metropolitan-Vickers Electrical Co., Ltd.

Nine armatures (£765).—English Electric Co., Ltd.

Repair of motor generators (net cost, plus 15 per cent., about £1,000).—English Electric Co., Ltd.

Manchester.—Paving Committee. Accepted:—

Motor for driving machinery.—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee. Accepted:—

Steel tramway axles.—J. Baker & Co. (Rotherham), Ltd.

Copper trolley wire.—R. Johnson & Nephew, Ltd.

Cadmium copper trolley wire.—Elliott's Metal Co., Ltd.

Block tin.—French & Smith.

Destination indicator.—English Electric Co., Ltd.

Special track work.—Edgar Allen & Co., Ltd.

Electricity Committee. Accepted:—

Supply and laying 33,000-volt cable.—Callender's Cable and Construction Co., Ltd., and Pirelli-General Cable Works, Ltd.

Modification of existing switchgear.—British Thomson-Houston Co., Ltd.

Salford.—Health Committee. Accepted:—

Electric wiring at 143 and 147, Regent Road (£122).—W. Anderton & Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—

Transformers (£5,771).—British Electric Transformer Co., Ltd.

Air pump at Blackburn Meadows generating station (£646).—Mirrlees, Watson Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted:—

Polyphase testing meter (£274).—South African General Electric Co., Ltd.

Steam piping for turbo set (£496).—Babcock & Wilcox, Ltd.

Cables (£1,035).—British Insulated Cables, Ltd.

Switchgear (£6,119).—A. Reyrolle & Co., Ltd.

Streets Committee. Accepted:—

Motors for electrification of plant at quarry (£1,528).—F. W. Searle.

Drainage Committee. Accepted:—

Electrical plant at sewage works (£690).—British General Electric Co., Ltd.

Germany-Sweden.—The Reich Ministry of Posts and the Swedish Postal Administration have in conjunction placed an order with the Felten & Guilleaume Company for a new cable for German-Swedish communication. It is to be laid next August between Zarrenzin, Pomeranis, and Kampinge, Sweden, and will have a length of 78 miles, plus 24 miles of land cable for connection with Stralsund and Malmo.

Uxbridge.—Works Committee. Recommended:—

Electrical water-indicating instrument (£84).—Glenfield and Kennedy, Ltd.

Electrical sirens at market house and waterworks (£208).—Walters Electrical Mfg. Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, February 4th. 39, Victoria Street, S.W. "The Theory of the Gyroscopic Compass," by Mr. P. R. Jackson.

Friday, February 11th. At 7.30 p.m. "The Physiology of Work under High Air Temperature Conditions," by Prof. K. N. Moss.

Diesel Engine Users' Association.—Friday, February 4th. Discussion on the "Report on Heavy Oil Engine Working Costs for 1925-26."

Electrical Power Engineers' Association (Southern Division).—Friday, February 4th. Institution of Electrical Engineers, London, W.C. "Pulverised Fuel and its Application to Boilers." Mr. R. B. Potter.

(Glasgow Section).—Friday, February 11th. Reids Restaurant, Glasgow. 7.30 p.m. "The Policy of the Association." Mr. G. E. Smith.

Society of Engineers.—Monday, February 7th. 5.30 p.m. Presidential address by Mr. D. C. Fidler.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, February 7th. London. 7 p.m. "Some Interesting Features in Modern Installation Work." Mr. R. Grierson.

Thursday, February 10th. Hotel Cecil. 7.15 for 7.45 p.m. Annual dinner.

(North-Eastern Centre).—Tuesday, February 8th. Central Station Hotel, Newcastle-upon-Tyne. 7 p.m. Annual dinner.

(North-Midland Centre).—Tuesday, February 8th. Hotel Metropole, Leeds. 7 p.m. Informal discussion on "Electric Heating and Cooking."

(North-Western Centre).—Tuesday, February 8th. Engineers' Club, Manchester. 7 p.m. "Electrical Equipment of Track on the Underground Railways of London." Mr. A. R. Cooper.

(Scottish Centre). — Tuesday, February 8th. McLellan Galleries, Sauchiehall Street, Glasgow. 7.30 p.m. Faraday lecture, "What is Electricity?" Prof. W. M. Thornton.

(South-Midland Centre).—Wednesday, February 9th. Midland Institute, Birmingham. Faraday lecture, "What is Electricity?" Prof. W. M. Thornton.

British Electrical Development Association.—Wednesday, February 9th. Sopwith's Lounge, Newcastle-upon-Tyne. 7.15 p.m. "Industrial Heating." Mr. S. E. Monkhouse.

Institution of Heating and Ventilating Engineers.—Wednesday, February 9th. Holborn Restaurant, London. 2.30 p.m. "The Effects of Weather Conditions upon the Heat Requirements of a House." Dr. Margaret Fishenden; and Presidential address by Mr. J. L. Musgrave.

Institution of Engineers-in-Charge.—Wednesday, February 9th. St. Bride Institute, E.C. 7.30 p.m. "The Use of Oil Engines for Private Installations." Mr. B. P. Dean.

Institution of Welding Engineers.—Wednesday, February 9th. Milton Hall, Manchester. 7 p.m. "The Welding of Cast Iron." Mr. P. L. Roberts.

Royal Institution.—Thursday, February 10th. 5.15 p.m. "Acoustic Problems—Echoes." Sir William Bragg.

Electromobile Association.—Friday, February 11th. Royal Society of Arts, London, W.C. 7 p.m. "The Use of Storage Battery-type Electromobiles." Mr. J. C. Elvy.

Electrical Trades Commercial Travellers' Association.—Friday, February 11th. Holborn Restaurant, W.C.1. 7 p.m. Annual dinner.

British Electrical and Allied Industries Research Association.—Friday, February 11th. At the Savoy Hotel, London, W.C. 12.45 for 1 o'clock. Luncheon—Annual general meeting.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, February 12th. Neville Hall, Newcastle. 3 p.m. "Failures in 3-phase Windings." Mr. R. G. Morgan.

(South Wales Branch).—Saturday, February 5th. Cox's Café, Cardiff. 6.30 p.m. Annual dinner.

(London Branch).—Tuesday, February 8th. Junior Institution of Engineers, London, S.W. 6.30 p.m. "Auto Synchronous Motors for Colliery Use." Messrs. H. O. Burge and C. S. Buyers.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

LUSTRAL glassware.

HOUGH watertight fittings.

Notes.

Registration of Engineers.

At a meeting of the Institution of Production Engineers, on January 26th, Mr. Richard Hazleton, Secretary of the Society of Technical Engineers, explained the aims of the Bill for the Registration of Engineers which is expected to be introduced again in this session of Parliament, and also the objects which the Society had in view. On the general question of the desirability of registration for engineers as a means of improving their status and protecting the public, Mr. Hazleton did not believe there was any difference of opinion among engineers; it was on the details for securing that end that the scheme was likely to meet with serious opposition. He reminded his audience that the Bill of the Institution of Civil Engineers, which was introduced about five years ago and was eventually withdrawn, practically provided that the Council of the Institution of Civil Engineers should be the Registration Authority, and it was because the other leading engineering institutions objected to this that the scheme failed. Discussing the reasons why the practically unknown and new Society should have introduced the Eill now, Mr. Hazleton said they were solely with the object of ensuring that some serious action should be taken in the matter. It was the hope of his Council that the Joint Engineering Council would take the matter up in an authoritative manner, and in that event the Society of Technical Engineers would be only too pleased to hand it over. The general scheme of the Bill was that there should be a General Registration Authority, but that the Councils of various engineering institutions, which would be scheduled to the Bill, should act as the registration authority for their particular members. A registration fee of £4 per annum was suggested, of which £1 would go to the Central Registration Authority and the remaining £3 to the particular institution under which the member became registered. It was proposed that the Central or General Engineering Council should consist of representatives of the Government, scientific institutions, universities and technical colleges, and engineering employers' and employés' organisations. The Bill had been framed, generally, on the constitution governing the General Medical Council. The object of making the Councils of the Engineering Institutions the actual registering authorities was to prevent a person registering with the General Engineering Council without being a member of any of the engineering institutions. Practising members of the institutions would be entitled to registration within two years of the passing of the Act. Persons who were not members of the institutions would be able to apply for registration on bringing satisfactory evidence that they had been engaged in responsible positions in the engineering industry for a period of not less than five years.

Mr. Hazleton pointed out that registration of engineers had been the law of the land for several years in many of the States of America. A similar measure had been in force in Italy for two years, and in New Zealand the registration of engineers had been in force since the middle of last year. He believed that if the Society of Technical Engineers was compelled to go ahead without the support of the leading engineering institutions, and was successful in getting a place in the Private Members Ballot, there were sufficient members of Parliament in favour of the general scheme of registration of engineers to ensure a second reading of the Bill and its committal to a Standing Committee, and then the leading engineering institutions would have to justify their position in not supporting the proposals.

Appointments Vacant.—Assistant mains engineer ($400 per month+dollar=2s. 4d.), for the Penang Municipal Commission Electricity Supply and Tramway Department. General, filing correspondence and shorthand clerks, for the West Midlands Joint Authority. Showroom salesman and two canvassers, for the Beckenham Urban District Council. Engineer and manager, for the Borough of Loughborough Electricity Department. (See our advertisement pages to-day.)

New Accumulator Separators.

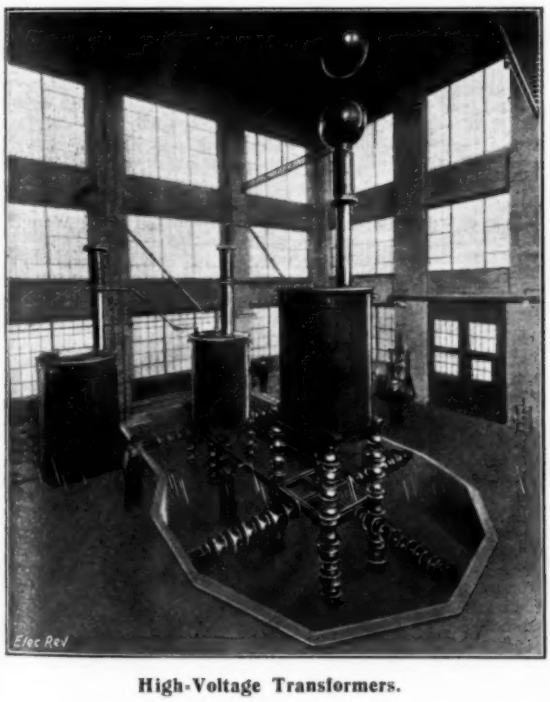
The subject of a recent demonstration at the Northampton works of the Electrical and Chemical Ebonite Co., Ltd., was the process of manufacture of a new accumulator separator which has been devised by Dr. Meyer Wilderman, and which is to be produced commercially by the above company. The invention is based on the necessity for increasing the concentration of the acid at the surface of the electrodes, and for this purpose introduces an automatic mixing and circulation of the electrolyte. This is brought about by means of a diaphragm of special construction and porosity for creating between the electrodes a hydrostatic and an increased electro-osmotic pressure. The separator, which is constructed in such a way that the electrolyte is unequally distributed between it and the electrodes, is made entirely of ebonite and is highly porous. This latter and essential feature of the device is brought about by treating a specially-prepared ebonite powder with pressure and heat. In each separator two porous diaphragms are held in ebonite non-compressible separating frames. These are stamped from sheets of the soft ebonite preparation before vulcanising, and by means of a horizontal press are made to adhere to lead-fin sheets, twelve being applied at one time. The frames are accommodated in grooves in the sheeting, which is stamped out

beforehand so as to give the required design and thickness to the diaphragms. The special powder referred to is then "spread" on the sheets so that it just fills up the spacings within the frames. This operation is performed by a somewhat complicated and ingenious piece of machinery of the firm's own design. The "spreading" of the powder is a delicate performance which, we understand, owing to the peculiar nature of the preparation, cannot be done by hand. A second sheet, suitably pressed to cover the frames and diaphragms, is placed in position, and the whole is clamped tightly together between suitable templet facings on the same machine which incorporates the spreading equipment. Held thus firmly and accurately in position between the sheets, the complete separators are vulcanised, after which the lead-tin foil is easily detached from the ebonite. After vulcanising, a surface tension exists between the diaphragm surface and the fluid, and this is removed by a special chemical treatment which leaves the diaphragm with an absorbing capacity somewhat approaching that of blotting paper. After a final grinding and polishing process, the separators are ready for immediate use.

Equipped with Wilderman separators, it is claimed, the efficiency of an accumulator will be considerably increased, its life substantially lengthened, and the volt-drop during discharge appreciably decreased. It is further claimed that the non-compressible frames counteract the bending and buckling of the electrodes in both the vertical and horizontal directions, thus constantly maintaining the correct conditions for the required distribution and circulation of the electrolyte. An important advantage of the separators is that they can be stored dry, either in or out of the accumulators. They can be made in any size, shape, or form.

A High-Pressure Testing Laboratory.

To ensure that the electrical equipment offered for sale will meet the severe conditions imposed on it by the super-power transmission systems in the United States, it is necessary to subject it to severe factory tests. A testing laboratory constructed by the Delta-Star Electric Company, Chicago, Illinois,



High-Voltage Transformers.

U.S.A., for the use of its designing engineers is shown in the accompanying illustration. The three transformers are each of 250 kVA capacity, and weigh approximately 18 tons. They are wound for a primary pressure of 2,000 V and a secondary pressure of 250,000 V, and are arranged for cascade or chain connection. Excitation and control of the transformer bank is secured by a synchronous motor-generator set, the 2,000-V winding of the first transformer being connected directly to the alternator. With the three transformers in series there is a pressure of 750,000 V between the high-pressure terminal of the third transformer and earth.

International Conference on High-Pressure Networks.

Preliminary arrangements have now been made for the 1927 session of the Paris E.H.P. Conference. It will be opened on Thursday, June 23rd, and will close on Saturday, July 2nd. During the interval the proceedings of the three Sections will be allotted two days each, from 9.30 a.m. to 4.30 p.m., and time will be found for visits to the power station of Eguzon (50,000 kW), the Paris-Orleans electric railways, and the transmission lines of that system, operating at 150,000 and 90,000 volts; there will also be excursions to Fontainebleau or Chantilly, and tours will be organised to the principal works and lines of the Alps and (alternatively) to the 150,000- and 90,000-V installations of the Midi railways in the Pyrenees.

Already 23 countries have arranged to participate in the proceedings; the list of subscribers will close on May 1st, but it is urgently desired that applications for membership shall be sent to the secretary as soon as possible, as the addition of large numbers during the last weeks upsets the organisation of the meetings. The cost is 250 francs, which covers copies of all the reports and participation in the sessions and fêtes.

An addition to the programme, at the request of an important member company, is the study of the measurement of energy at very high pressure; communications on this subject can be received (exceptionally) up to March 1st in one language. As decided in 1925, not more than 60 papers will be discussed this year. Papers submitted in both French and English can be received up to March 1st.

Amongst those already received are the following from British authors:—

Messrs. A. R. Everest, A. C. Michie, and E. B. Wedmore: Review of researches on insulating oils.

A nominee of the Cable Makers' Association: High-pressure cables.

E. T. Painton: High-pressure lines of aluminium-steel cable.

F. H. Riddle: The raw materials of porcelain.

R. Borlase Matthews: Distribution lines on farms.

V. Ferranti: Suppression of pressure waves in h.p. networks.

W. W. Lackie: The Electricity (Supply) Act in Great Britain.

The following papers have been received from the United States:—

C. Mailloux: The rational use of combustibles.

H. W. Young: Open-air installations.

J. T. Barron: A distribution network in New York.

Apart from the Sectional activities, Mr. C. Le Maistre has contributed a paper on national standardisation in various countries and the co-ordination of effort towards international unification.

The "Phonoscope."

The Westinghouse Electric and Manufacturing Co.'s "Osiso" is a single-element oscilloscope which may be used as an oscillograph. The instrument is remarkably light and portable, and will operate off dry cells. For electrical engineering work, it can be used to show alternating-current wave-forms and phase relations and, by adding a synchronously-driven film holder, it may be used to photograph six different a.c. wave-forms and phase relations. Also, it may be used as a "phonoscope" to enable totally deaf persons to understand speech by viewing the audio-frequency waves of the output of any good radio receiving set or telephone. A spot of light, reflected from the mirror of the galvanometer, moves back and forth on the ground glass of the "Osiso," following the instantaneous changes in the current; a rotating polygon of mirrors gives a time component to the moving spot of light so that an observer may see waves of light. Each sound has a different wave shape: a pure note appears as an endless repetition of a "sine" wave. The height of the wave is a function of the loudness of the sound; the length of the wave, from crest to crest, is inversely proportional to the frequency; thus, with each sweep of each mirror, the number of oscillations that appear stretched out in a record of light are proportional to the frequency of the note. When a high note is being viewed many oscillations are apparent with each sweep of each mirror; when a low note is being viewed, only a few oscillations appear for each sweep of each mirror. The waves change with pitch and with different voices, but certain similar characteristics remain for each vowel sound. Any ordinary telephone microphone may be connected in series with dry cells and the vibrator ribbon of the "Osiso"; one may speak into the microphone and see the voice waves dance in the rotating mirrors. A single step-down audio-frequency transformer is used between any radio receiving set and the vibrator ribbon, any signal that will operate a loud speaker giving sufficient deflection; if the primary of the transformer is connected in series with the loud-speaker coil, one may hear and see the audio-frequency at the same time. No photographic action is required to receive the audio-frequency waves. A deaf person may be taught to understand speech by sight in a class and, though such instruction would take much time, it seems probable that it would be more successful than the method of reception by feeling.

Electrification and the Electricity Act.

In the *Quarterly Review* for January, Sir Charles Bright, F.R.S.E., discusses the subject indicated in the title, from the standpoint of the onlooker who accepts without question the statements of the supporters of the Government scheme, and is ready to attribute our industrial difficulties mainly to our backwardness in the use of electricity. In the space of 16 pages it is, of course, impossible to take account of all relevant considerations, but without doing so it is equally impossible to draw fair comparisons between the progress made in this country and that made abroad. For instance, Switzerland has no coal and perforce must use her water

power, which means that she *must* use electricity lavishly—there is no alternative. We, on the other hand, have developed gas lighting to a remarkable degree, and electricity is heavily handicapped in the race, but nevertheless is making extraordinarily rapid progress. As for the statistics freely quoted by the author, we have repeatedly shown how unreliable they are. Belgium, for instance, is said to put "England far behind her in the matter of electricity." In point of fact, as we recently showed, there is very little difference. However, the author takes a hopeful view of the future.

A Colour-Lighting Demonstration.

On January 11th, the members of the General Council of the Cinematograph Exhibitors' Association attended a lecture on "Colour Lighting and its Future Application to the Kinema" in the miniature theatre attached to the showrooms of Messrs. Holophane, Ltd., when the effects of colour on the stage and film were demonstrated in conjunction with the use of a new range of stage-lighting equipment, "Duo-Phantom," which has been introduced by the company, and which we hope to describe in a later issue. The lecturer outlined the theory of colour, explaining and demonstrating the formation of the many colours from combinations of the basic ones. Some very striking and curious effects were shown. A man on the stage was made to appear as a negro, and the costume of a girl was represented as something entirely different to that which she was wearing It was also shown how, by a pre-selection of the material, the stage curtain could be made to appear in many entirely different colours and designs. A film was projected and made to float in a surround of colour which changed as the film went on to suit the emotional change of the various scenes a little in advance, suggesting to the audience what was shortly coming in the story. The title of the film was shown on a coloured, instead of a black, background, with the effect that it was much easier to read. The value of colour-lighting the kinema entrances, lobbies, vestibules, and waiting rooms was emphasised, and it was pointed out that if it definitely paid to increase the intensity of light in shop windows, then the practice could with benefit be applied to the kinema entrances.

The Shannon Scheme.

It is reported that the three turbines for the partial development of the Shannon scheme are being built by the firms of Voith and Escher, Wyss, sub-contractors to Messrs. Siemens-Schuckert, the German contractors for the scheme. Survey parties are engaged in surveying the route of the 110,000-V line between Limerick, Dublin, and Cork. The line will be carried by steel poles of an average height of 50 ft. The final survey of the cable routes *via* Dublin-Wexford-Waterford-Kilkenny-Carlow-Maryborough will soon be completed. Both main and auxiliary lines will be completed next summer. The latter line will have a voltage of 38,000. Distant towns from the main line will be linked up by 10,000-V lines radiating from transformer stations.

The Electromobile Association.

An informal meeting of the above Association will be held on February 11th at 7 p.m. at the Royal Society of Arts, John Street, Adelphi, Strand, when a general discussion will be opened by Mr. J. C. Elvy on "The Use of Storage Battery-type Electromobiles." The chair will be taken by Mr. J. H. C. Brooking, M.I.E.E. Tickets may be obtained on application to the Association, 3-7, Southampton Street, Strand, W.C.2.

Service Notes.

VACANCIES FOR NAVY ELECTRICIANS.—The quarterly schedule of recruiting for the Royal Navy and Royal Marines shows increases in certain of the technical grades, and *The Times* points out that the outstanding feature of the list is the decision to enter 56 electrical artificers, more than double the usual quota. This is an attractive branch of the Service. Candidates must be efficient fitters and turners, or instrument makers, with at least five years' practical experience. No electrical knowledge is necessary on joining, a long training course being given. Pay begins at £2 16s. a week, with rations, accommodation, free kit, &c., and rises to £4 0s. 6d. a week according to rating. On promotion to warrant rank the pay is from 14s. 2d. to 17s. a day; to commissioned warrant rank, 18s. 10d. to 24s. 6d. a day; and to electrical lieutenant, 26s. 6d. to 34s. a day if promoted to electrical lieutenant-commander with the necessary qualifying service.

Those who do not reach warrant or commissioned rank may earn a pension after 22 years' qualifying service of approximately £100 a year. Warrant officers can earn up to £170 per annum retired pay, commissioned warrant officers up to £236, electrical lieutenants up to £284, and electrical lieutenant-commanders up to £331. The present openings are due to an unusually large number of time-expired men leaving the Service.

VACANCIES FOR AIRCRAFT APPRENTICES.—Five hundred aircraft apprentices, between the ages of 15 and 17, are required by the Royal Air Force for entry into the Schools of Technical Training at Halton, Bucks., and at Flowerdown, near Winchester. They will be enlisted as the result of an open competition and of a limited competition held by the Civil Service Commissioners and the Air Ministry respectively. Full information regarding the aircraft apprentice scheme can be obtained on application to the Royal Air Force, Gwydyr House, Whitehall, London, S.W.1. One of the trades open to boys is that of wireless operator-mechanic.

Swiss Electricity Exporters' Union.

Under the title of the Union des Exportateurs d'Energie Electriques, a body has lately been formed in Switzerland with headquarters at 29, Avenue de la Gare, Lausanne, to protect the interests of the Swiss undertakings "exporting" electrical energy.

Amplifiers for Community Singing.

The *Daily Express* community singing movement has met with an enthusiastic reception, and we learn that arrangements are being made for it to be extended to open air meetings all over the country. The problem of how to address the large audiences has been solved by the use of Marconiphone "Public Address" amplifiers, which were employed for the purpose in the Albert Hall, at Birmingham on January 1st, and at Swansea and Reading on January 8th, and will be a feature in future arrangements.

Chiswick Power Station.

It is reported that the Bill promoted by the London and Home Counties Joint Electricity Authority, seeking powers compulsorily to acquire land at Chiswick (Duke's Meadows), on which to erect a super-power station, will probably not be proceeded with in the coming Parliamentary session. The examiner of private Bills, after hearing allegations on behalf of the Barnes Urban District Council, that the Standing Orders of Parliament had not been complied with, gave his decision on January 26th, to the effect that the allegations had been sustained in several important respects. The promoters will therefore have to consider whether it is worth while to apply to the Standing Orders Committee for dispensation.

The Engineers' Club (London).

The fifth annual general meeting of the Engineers' Club (London) was held at the Club premises, Coventry Street, on January 26th, when the president, Sir Joseph W. Isherwood, Bt., occupied the chair. Reviewing progress during 1926, he pointed out how, in spite of the extreme difficulty of the period, the results exhibited very substantial support, and proved that the Club itself was a well-needed rendezvous of both the professional and the commercial engineer. The report and accounts were received and approved. Sir J. Fortescue Flannery, Bt., M.Inst.C.E., past president Institute of Marine Engineers, was unanimously elected president of the Club for the year 1927. Messrs. Vizard, Oldham, Crowder and Cash were re-elected honorary solicitors, and Messrs. Chantrey, Button & Co. were re-appointed auditors.

During February thirteen meetings are to be held at the Engineers' Club by 11 associations, mainly of engineers, including the Batti-Wallahs' Society, the I.E.E. Wireless Section, the Associated Municipal Electrical Engineers, and the Institute of Wireless Technology.

Lecture.

Mr. S. Gordon Monk, B.Sc., Department of Engineering, Plymouth Technical College, lectured to the members of the Plymouth Institution on January 27th, on electric furnaces, particularly with regard to iron smelting and refining, and steel production. The advantages of electrical treatment were the avoidance of contamination, minimum loss of heat, more compact and cleaner plant, precise control of temperature, and the fact that the exact composition of the final steel was known and specific samples could always be reproduced. Mr. Monk illustrated his lecture with lantern slides and demonstrations. A model of an induction furnace was shown, and Mr. Monk mentioned that the idea was in use at the Compton depôt of the Plymouth Corporation tramways for expanding steel tires for shrinkage on to wheels.

Fatality.

Whilst working at Blackburn Infirmary, on January 25th, Thomas Austin, apprentice electrician, was killed. At an inquest on January 27th a witness said that to secure a light he plugged one adaptor to another, and placed a bulb into the lampholder. He then received a shock which threw him against the hoardings. Recovering, he told another man something was wrong with the lamp. Another workman said he switched off the current at the main before the deceased fixed the bulb in the holder. Witness heard him shout, and saw him holding the wires with both hands. The workman thereupon tore the wires from the switchboard, and Austin fell to the floor. John Holliday, electrical foreman, said temporary cables had been run to enable the plasterers to work overtime. The holder and the lamp were in perfect order. He thought that the interior of the lampholder had been turned round when the lamp was put in, causing one of the screws to touch the case of the holder. He could not account for the wire being alive; the current could not have been switched off. The Coroner returned a verdict of "Accidental death."

National Association of Supervising Electricians.

The twelfth annual dinner and musical evening is to be held at the Holborn Restaurant, London, on February 26th, 1927. The President of the Association, Mr. A. M. Sillar, M.Inst.C.E., will preside, and will be supported by many other distinguished engineers.

Educational.

FARADAY HOUSE SCHOLARSHIPS.—The annual examinations for a Faraday and a Maxwell scholarships, each of fifty guineas per annum and tenable for two years in college and one year in manufacturing works, will be held on April 5th, 6th and 7th, 1927. Exhibitions may also be awarded to candidates who acquit themselves creditably but do not qualify for a scholarship. Particulars are obtainable from Faraday House, 62, Southampton Row, London, W.C.1.

Bauxite.

According to a German metallurgical journal, the world production of bauxite in 1926 amounted to 1,475,000 tons, as compared with 928,000 tons in the previous year, the French mines again occupying the first position with 440,000 tons last year.

Electrical Association for Women.

The first meeting in the new year of the Manchester District Branch was held on January 12th in the Lecture Hall of the Y.M.C.A. The Singer Sewing Machine Company gave a very interesting demonstration of its electric sewing machine, and entertained the members at tea. On January 19th members visited the all-electric house at Denton, which is open in connection with the "Wiring the Homes of Britain" campaign.

The lecture given earlier in the winter by Mr. R. C. Hawkins, of the Lighting Service Bureau, on "Lighting in the Home," proved so useful that it was decided to repeat it for members who were unable to attend the last meeting. This lecture was given on Monday evening, January 24th, and was very much appreciated.

Institution Notes.

Institution of Electrical Engineers.

ANNUAL DINNER.—Applications from members to attend the annual dinner on February 10th have been received in such large numbers that all the tickets have been disposed of, and it will not be possible to issue any tickets for non-members other than the official guests. Arrangements have, however, been made for additional accommodation in the Oak Room (immediately adjoining the Grand Hall). At the conclusion of the dinner the boxes and gallery in the Grand Hall will be thrown open to those who will have dined in the Oak Room, to enable them to hear the after-dinner speeches. Those wishing to avail themselves of the accommodation in the Oak Room are requested to communicate with the secretary of the Institution immediately.

Institution of Public Lighting Engineers.

CHANGE OF ADDRESS.—We have been notified by the hon. secretary of the above-named Institution, Capt. W. J. Liberty, that its address has been changed to: General Buildings, Aldwych, London, W.C.2.

Junior Institution of Engineers.

On Friday last, a paper on the "Design of High-Pressure Sub-stations" was delivered by Mr. C. E. Atkinson, A.M.I.E.E. The lecturer held that self-cooled 3-phase transformers should be used wherever the size and transport facilities permitted, and metal-clad switchgear for voltages up to 35,000 V. He considered that outdoor switchgear should be used for higher voltages.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

MR. R. WILSON JONES, A.M.I.E.E., A.M.Inst.M. & Cy.E., electrical engineer, Locomotive Superintendent's Department, Federated Malay States Government Railways, is at present in England on eight months' furlough. His temporary address is, c/o The Engineers' Club, Coventry Street, London, W.1.

A presentation has been made to Mr. R. P. JONES, district representative of the Kidderminster Lighting and Traction Co., Ltd., who is leaving Kidderminster to take up a post at Halesowen.

MR. R. B. LEACH has resigned the post of borough electrical engineer to Loughborough Corporation owing to ill-health, after 11 years' service.

The Manchester Corporation Electricity Committee has recommended the appointment of Mr. W. H. DUNCAN, of Newcastle-on-Tyne, as chief mains engineer.

A correspondent states that Mr. R. GREGORY, formerly a member of the Mold Council and chairman of the Electricity Committee, has been appointed electrical engineer to the Mold Council, at a salary of £300 per year.

It is reported in the Press that Captain W. J. LIBERTY, the Lighting Inspector to the City of London Corporation, has retired after 30 years in charge of the street lighting of the City.

Mr. T. H. WILLIAMS, electrical engineer to the Hoyland Silkstone Coal and Coke Co., who has become mining representative in the Yorkshire and Lancashire coalfields for the Marconiphone and Sterling Telephone and Electrical Companies, has been presented by the electrical staff with a fountain pen.

The Kingston-on-Thames Town Council has granted the borough electrical engineer, Mr. T. A. KINGHAM, six weeks' leave of absence, as he is suffering from the effects of overwork and strain to which he has been subjected during the past year. He has left for the Canary Islands, and during his absence Mr. P. C. SIMPSON is acting borough electrical engineer.

CAPT. I. MACKINTOSH, consulting engineer, Midland Bank Chambers, Wigan, closed his office on January 31st on taking over the general managership of the Corlett Electrical Engineering Co., Wilcock Street, Wigan. He asks that all correspondence for him should now be sent to the latter address.

The Leeds City Council has been recommended to grant salary increases to eleven principal municipal officials, including Mr. C. N. HEFFORD, city electrical engineer (from £1,600 to £1,650), and Mr. W. CHAMBERLAIN, tramway manager (from £1,500 to £1,600).

Cape Town Electricity Committee recently recommended that the salary of the city electrical engineer should be increased from £1,500 to £1,750 per annum.

Mr. G. A. HARRISON, district engineer to the West Gloucestershire Power Co., Ltd., has been presented by the employés with a suitcase on his resignation to take up a post abroad.

The Long Eaton Urban District Council has adopted the minimum salary scale of the Associated Municipal Electrical Engineers (Great Britain and Ireland) for the purpose of fixing the salary of its electrical engineer and manager, Mr. F. NEWEY.

A reference to the presentation made to Mr. CHARLES VERNIER on his leaving to take up his new appointment appears below.

Mr. G. L. PORTER, A.M.I.E.E., late of Messrs. Merz and McLellan, has joined the staff of Ferranti, Ltd., as advisory engineer.

Obituary.—MR. J. T. RAMSAY.—We regret to record that on January 25th Mr. John Thomas Ramsay, assistant superintendent of traffic in the Telephone Department of Glasgow Post Office, was knocked down and killed within 100 yards of his home by a motor-'bus.

MR. W. H. GUY.—We regret to learn that Mr. W. H. Guy, who was at one time connected with electrical and other technical publications, passed away on January 22nd, after a very brief illness.

MR. C. E. ELDER.—We deeply regret to record the death, which occurred with tragic suddenness last Saturday evening, of Mr. Charles E. Elder. He was one of a happy company assembled at the Savoy Restaurant, Newcastle, to make the farewell presentation of testimonials to Mr. Charles Vernier, for many years chief mains engineer, Newcastle-upon-Tyne Electric Supply Co., Ltd., who is joining the Macintosh Cable Co., Ltd., of Liverpool, as chief engineer. Mr. Elder was one of the soloists, and he expired suddenly after singing a song. Mr. Vernier received a silver coffee service from his colleagues in the company and a silver cigarette-case and a crystal cut-glass flower vase from the contractors who undertake work for the company from time to time. The presentation ceremony was necessarily of a formal character on account of the sad occurrence, and the proceedings came to an abrupt termination. Sincere sympathy with Mr. Elder's widow and relatives was expressed. Mr. Elder, who was about 57 years of age, was Mr. Vernier's chief assistant in the mains engineering section, and had been in the company's service for nearly 38 years. He was popular with all the staff. He had been in indifferent health for some time.

MR. A. J. WILKINS.—We regret to announce that Mr. A. J. Wilkins died suddenly on January 27th. He was associated with Messrs. G. E. Taylor & Co., as engineer and manager, from the commencement of the firm in 1899. Previously he was connected with Messrs. Laing, Wharton & Down, Ltd., for about 10 years. He was well known throughout the contracting industry, and will be greatly missed.

MR. C. G. VALLANCEY.—*The Times* records the death, in his 62nd year, of Mr. Charles George Vallancey, late of the Western Telegraph Co., Ltd.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Lisburn Electric Supply Co., Ltd.—Registered in Belfast January 18th. Capital, £100 in £1 shares. Objects: To carry on business as indicated by the title. The directors are:—E. S. Dashwood, Laurel Bank, Windsor Avenue, Belfast, electrical engineer; A. E. Salmon, Browne End, Bucks; Sir Robert J. Lynn, Kt., Belfast; Edward S. Clarke, Lisburn. Qualification, 20 shares. Secretary: J. G. Megaw. Registered office: Coates Buildings, Belfast.

Archibald Bryce & Co., Ltd.—Private company. Registered January 25th, in Edinburgh. Capital, £3,000 in £1 shares. Objects: To carry on the business of general manufacturers, merchants or traders, agents for and dealers in electrical and mechanical supplies, engineering and colliery supplies and furnishings, &c. The first directors are:—A. Bryce, 16, Whitehill Street, Dennistown, Glasgow, electrical engineer; J. Kinloch, 5, James Street, Whiteinch, Glasgow, electrical engineer. Qualification, one share. Secretary: G. Gibb. Registered office: 257, West Campbell Street, Glasgow.

Alldays & Onions, Ltd.—Registered as a private company on January 24th.. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in fans, blowers, furnaces, power or other hammers, forges, cranes, and lifting tackle, &c. The subscribers (each signing for one share) are:—A. T. Cocking, J.P., Hartopp Court, Four Oaks, Warwickshire; H. C. Chambers, Kerri, Blakesley Road, Yardley, Birmingham, solicitor's managing clerk. No share qualification necessary. Solicitors: Pinsent & Co., 6, Bennett's Hill, Birmingham.

Chromium Plating and Development Co., Ltd.—Private company. Registered January 28th. Capital £15,000 in £1 shares. Objects: To acquire from E. V. Hayes-Gratze, M. Fink, and A. Hurter the benefit of certain existing inventions of processes relating to the electro-deposition of chromium, and to carry on the business of chromium miners, electro platers, metallurgists, &c. The first directors are:—E. V. Hayes-Gratze, 1, Gledhow Gardens, South Kensington, S.W.5, engineer; A. Hurter, 27, Soho Square, W.1, engineer; S. D. Kittel, address not stated. Qualification, 400 shares. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.2.

Electric Fans, Ltd.—Private company. Registered January 29th. Capital, £500 in £1 shares. Objects: To adopt an agreement with S. J. Flatau and B. Freedman, to acquire the registered trade mark "Manda." No. 452,496, Class 7, and to carry on the business of manufacturers of, and dealers in electric fans, electric motors, mechanical signs, &c. The first directors are:—S. J. Flatau (chairman), 4, Kidderpore Gardens, Hampstead, N.W.; B. Freedman, 549, Finchley Road, N.W.; and V. Delebecque, 26a, St. Peter's Square, Hammersmith, W. The first two named are permanent. Solicitors: M. A. Jacobs, 73 and 74, Jermyn Street, S.W.1. Registered office: 53 and 54, Royal Mint Street, E.1.

Ruud Manufacturing Co., Ltd.—Private company. Registered January 29th. Capital, £20,000 in £1 shares. Objects: To carry on the business of manufacturers and suppliers of automatic and other types of water heaters, mechanical and electrical engineers, machinists, smiths, founders and fitters of brass, iron, and other metals, &c. The first directors are:—E. Ruud, 240, South Graham Street, Pittsburgh, gas engineer; A. P. Brill, 712, St. James Street, Pittsburgh, secretary; E. J. Horton, 330, Gross Street, Pittsburgh, U.S.A., mechanical engineer; E. C. A. Bliault, 5, Carlton Gardens, Ealing, W.5, merchant; A. J. Greenop, 6, Riverview Mansions, East Twickenham, solicitor. Qualification: 5 shares. Remuneration (except managing director, if any), as fixed by the company. Solicitors: A. J. Greenop & Co., Bush Lane House, Cannon Street, E.C.

E. A. Dale, Ltd.—Private company. Registered January 31st. Capital, £1,000 in £1 shares. Objects: To carry on the business of factors of, agents for and dealers in electrical goods and appliances, and materials, and plant for manufacturing wireless goods, wires and cables, lamps and shades, &c. The first directors are:—E. A. Dale, "Caledol," Tennis Court Drive, Leicester, electrical agent; A. Dale, 47, Devonshire Road, Sherwood, Nottingham, surveyor. Qualification, 100 shares. Solicitors: Whetstone & Frost, Leicester.

Official Returns of Electrical Companies.

British Electric and General Insulators, Ltd. (197,340).—Capital, £1,000 in £1 shares. Return dated May 16th (filed October 18th), 1926. Two shares taken up. £2 paid. Mortgages and charges, nil.

Refty Electrical Appliances, Ltd.—W. E. Fisher, of 12, Old Square, Lincoln's Inn, W.C.2, ceased to act as receiver or manager on January 8th, 1927.

Neutron, Ltd.—H. Hackett, C.A., of 448, Strand, W.C.2, was appointed receiver on January 18th, 1927, under powers contained in instrument dated September 29th, 1924.

H. L. Wood & Son, Ltd.—Mrs. L. O. L. Wood, of 7, Tasswell Road, Southsea, was appointed receiver and manager on January 13th, 1927, under powers contained in debentures dated November 17th, 1925.

Stensigns, Ltd.—A. B. Burbridge, of 32, St. James' Street, S.W.1, was appointed receiver and manager on January 17th, 1927, under powers contained in debenture dated January 30th, 1926.

Deansgate Electro-Radio (Manchester), Ltd.—Debenture dated January 10th, 1927, to secure £775, charged on the company's property, present and future, including uncalled capital. Holder: C. Leeming, 10, Merton Road, Cheadle Heath, Stockport.

Wireless Experts, Ltd.—D. V. L. Craddock, of 2, Forbury, Reading, ceased to act as receiver on December 29th, 1926.

A. E. Acton-Burnell, Ltd.—G. Sunley, of 9-11, Copthall Avenue, E.C., was appointed receiver and manager on January 11th, 1927, under powers contained in debenture dated July 31st, 1923. R. Paiba, of 73, Basinghall Street, E.C., ceased to act in the above capacities on January 11th.

Atlas Light and Power Co., Ltd.—Particulars filed of £2,089,757 debenture stock (inclusive of £1,200,000 secured by trust deeds dated March 12th, 1909, February 10th, 1922, and July 16th, 1923), plus premiums relating thereto, authorised by resolution of December 31st, 1926, and covered by supplemental trust deed of same date, the amount of the present issue being £889,757 5 per cent. debenture stock. Trustees:—Col. C. W. Trotter, C.B., W. K. Whigham, Earl of Dunmore, V.C., M.V.O., and N. G. Touche. The present issue of stock is redeemable at 105 per cent., ranking *pari passu* (except as regards interest and redemption) with the debenture stock already authorised. The company has power to issue further stock ranking *pari passu* with the above 6 per cent. and 5 per cent. stocks at varying rates of interest, but so that such further stock with the £889,757 debenture stock shall not exceed half the nominal capital of the company beyond 1,925,211 £1 shares now issued).

Hall Telephone Accessories, Ltd. — Debenture dated January 6th, 1927, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: British Stamp and Ticket Automatic Delivery Co., Ltd., 70, Dudden Hill Lane, N.W.

New Phonopore Telephone Co., Ltd.—Debenture dated January 19th, 1927, to secure £100, charged on freehold factory at Southall, and company's undertaking. Holder: A. F. Liddell, 26, Austin Friars, E.C.2.

Buenos Aires Town and Docks Tramways, Ltd.—Trust deed dated December 31st, 1926, to secure £100,000 7 per cent. debenture stock, charged on the company's undertaking and property, present and future, including uncalled capital, with power to create any mortgage or charge ranking *pari passu* with or in priority to the stock, except as provided in the trust deed. Trustees: Law Debenture Corporation, Ltd., 24, Old Broad Street, E.C.

Shenton & Co., Ltd.—W. B. Pearson, of 5, John Street, Bedford Row, W.C.1, was appointed receiver and manager on February 25th, 1926, under powers contained in first mortgage debentures dated July 16th, 1925. (Notice filed January 21st, 1927.)

Pickvance, Ltd.—Issue on January 21st, 1927, of £250 debentures, first part of a series already registered.

City Notes.

Singapore Traction Co., Ltd.

The report which is to be presented at the annual meeting on Wednesday next covers a period of 14½ months (ended September 30th last) from the date of the company's incorporation. The undertaking was acquired from the receiver and manager of the Singapore Electric Tramways, Ltd. (in liquidation). After transferring £5,000 to depreciation and renewals account and carrying forward £7,028, there remains a sum of £20,000, one-half of which is payable to the managers, the remaining half being available for dividend. The directors recommend the payment of a dividend of 5 per cent. on the 7 per cent. cumulative preference shares. The profits for the first year of operation include £10,180 from the power station, derived mainly from the supply to the Municipal Commissioners, which was discontinued in October last. At the date of the accounts, 35 trolley-buses had been put into service on a route of 6¼ miles, and a further 20 were in hand. The company has made an agreement with the Municipal Commissioners to take a supply from the municipal power station, thus avoiding expenditure upon the power plant.

Fife Tramway, Light and Power Co., Ltd.

The subsidiaries of this company earned a trading profit of £75,605 during the past year, as compared with £114,098 in 1925. The company receives a sum of £65,436 and, after meeting expenses, has a balance of £54,348. To this is added £9,694 brought forward, making £64,042. It is proposed to pay a dividend of 3 per cent. on the ordinary shares (against 6 per cent.) and to carry forward £6,145. In 1925 £10,500 was transferred to reserve. The meeting is to be held at Edinburgh to-day (Friday).

A Franco-Swiss Investment Bank.

The Banque Général pour l'Industrie Electrique is the title of an investment undertaking which has been formed in Geneva, with a share capital of 20,000,000 Swiss francs, for the purpose of carrying out financial operations in connection with the examination, establishment, and working of electrical undertakinga. The bank has been constituted under the leading of the Union Financière of Geneva in Switzerland, and in France under that of the Credit Commercial de France and the Compagnie Générale d'Electricité.

Melbourne Electric Supply Co., Ltd.

The recently-issued accounts cover a period of 9 3/5 months. Against the receipts is charged a sum of £345,000 under the agreement made with the State Electricity Commission. The balance on trading account is thus reduced to £216,142, as compared with £567,610 in the previous period (14⅔ months). After meeting debenture interest, &c., and crediting interest received, there remains a balance of £102,989. The reserve for income tax receives £18,000, and to the balance is added £14,254 from general reserve. A final dividend of 5 per cent. actual is recommended on the consolidated ordinary stock, making 10 per cent., free of British income tax, for the year, and the balance of £3,195 will be paid over to the State Electricity Commission. The directors state that it is intended to continue to pay 10 per cent. on the ordinary stock. The rate is fixed at 7 per cent., but the balance is made up from income from investments.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Smith (S.) & Sons (Motor Accessories), Ltd.—400,000 7½ per cent. cumulative preference shares of £1 each partly paid and fully paid, Nos. 1 to 400,000.

The undermentioned securities have been ordered to be officially quoted:—

Perak River Hydro-Electric Power Co., Ltd.—£1,250,000 5 per cent. guaranteed debenture stock, 1951.

Tottenham District Light, Heat and Power Co.

The directors recommend the following dividends in respect of the half-year ended December 31st last:—At the rate of 5½ and 5 per cent. on the preference stocks; at the rate of 7½ per cent. on the "A" stock; and at the rate of 6½ per cent. on the "B" stock. Similar dividends were paid for the previous six months.

Westinghouse Brake and Saxby Signal Co., Ltd.

The net profit for the year was £157,922, and the amount available, after meeting debenture interest, &c., and adding £7,866 brought forward, is £138,177. Of this £10,000 is put to reserve, £30,800 is written off expenses, and it is proposed to pay a dividend of 8 per cent. (against 6 per cent.), leaving £10,254 to be carried forward.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the register, and they are thereby dissolved:—

Borra Magneto Repairing Co., Ltd.
Multi-Electrode Radio Valve Co., Ltd.
Savoy Electric Construction Co., Ltd.
Woodhouse & Baillie Riviera Electricity Co., Ltd.

Companies to be Struck Off the Register.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

B. Barnett (Electrical Engineering), Ltd.
British Generator Co. (1922), Ltd.
British Homo Wireless Co., Ltd.
Broadcasting Installations, Ltd.
Eclat Electrical Accessories (Paddington) Co., Ltd.
Electronic Devices, Ltd.
Hull Wireless Co., Ltd.
Prior's Television (Parent Company), Ltd.
Radio Products, Ltd.
Reynard Electrical Co., Ltd.
Wilmore's Wireless, Ltd.

Metropolitan Railway Co.

A final dividend of 1½ per cent. has been declared on the ordinary stock, making 3 per cent. for the year, as against 5 per cent. for 1925. £100,000 has been taken from the reserve. The final dividend on the Surplus Land stock is 2¼ per cent., making 3¾ per cent., as against 3½ per cent for the previous year.

United Alkali Co., Ltd.

At a recent board meeting, Mr. Holbrook Gaskell (one of the existing directors) was appointed a managing director, and the following gentlemen were appointed additional directors of the company:—Sir Alfred Mond, Sir Harry McGowan, Mr. J. G. Nicholson, and Lieut.-Colonel G. P. Pollitt.

City of Buenos Ayres Tramways Co. (1904), Ltd.

A final dividend of 1¼ per cent., making 5 per cent. for the year (as in 1926), has been declared. It is proposed to transfer £5,500 to amortisation and general fund and to carry forward £15,114.

New Issue.

Ascot Gas and Electricity Co., Ltd.—Last week the company's agents invited tenders for 3,000 6-per-cent. preference shares of £10 each, to rank with the existing preference shares.

The A.E.G.

It is reported that the net profit of the Allgemeine Elektricitäts Gesellschaft for the past year was 10,761,000 marks, and a dividend of 7 per cent. has been declared.

Western Union Telegraph Co. (Inc.).

The gross revenue for 1926 was $136,445,900, and the net surplus, after providing for debt interest, &c., was $15,223,143.

Cable, Telephone and General Trust, Ltd.

The dividend has been declared for 1926 on the 6 per cent. cumulative preference shares.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets suffered from disappointment at the retention of the Bank Rate at 5 per cent., consequent upon the Chinese riots and the dispatch of troops from this country to the scene of action. There was a temporary check to the pleasant cheerfulness that had previously prevailed, and a drop in the new Consols spread general dullness amongst investment stocks. But neither investor nor speculator permitted the foreign disturbances to ruffle for long his confidence in the financial prospect, and therefore the Stock Exchange price lists show long strings of rises—substantial in many cases—in to-day's quotations as compared with those of the beginning of the year. The Home Railway sections are amongst the few that reveal losses, but these are mostly confined to the ordinary stocks, for the pre-ordinary issues are firm as a rule, improvements being registered in some instances.

Had not a nominal fall occurred in Edmundson's ordinary, caused by the marking of the price ex dividend, the particular section in which the shares are quoted would be void of alteration this week. Debenture stocks are better, the chief changes being gains of 4 points in County of London Electric first and second debenture stocks. The company has formulated an interesting plan, details of which appeared last week (ELECTRICAL REVIEW, page 147), under which the proprietors of the 4½ per cent. first debenture stock are offered £115, and of the

second debenture stock £112 10s., in the new 4 per cent. Consols. The first debenture is redeemable at 115 and the second at 105, at the option of the company. Meetings of proprietors are called for February 17th to consider the necessary resolutions. The latter must be passed by a 75 per cent. majority for them to become effective. The Board has given proprietors ample time to think over a matter that requires serious attention. Most proprietors will elect, we imagine, to accept terms which are undoubtedly attractive.

Brazilian Tractions remain amongst the most volatile shares in Stock Exchange markets. The price went ex 1½ dollars dividend last week, and had been up to 119. The present quotation of 117 is not far short of the recent best, allowing for the dividend. Rumour declares that the struggle for control has been renewed, and mentions the name of Mr. Alfred Loewenstein in this connection. It was this gentleman's offer that drew from the president of the Brazilian Traction Board such an extremely definite snub some few months back.

Marconis have been undergoing a series of abrupt transitions between firmness and weakness. After their jump to 17s. the price reacted to 15s. The movements are supposed to be actuated by bull and bear anticipations of the forthcoming issue of the report that has reached the sub-committee's hands. However great has been the vigilance exercised to stop any possibility of leakage, it is difficult to suppose that no information at all has been permitted, perhaps almost unconsciously, to filter through. Marconi Marines are 1/16 lower at 22s. 6d., notwithstanding the attention drawn to the shares in some directions, as a good speculative investment.

Cable stocks and shares are steady, but exhibit little vitality. Anglo-American preferred and deferred have gained small amounts. Indo-Europeans are down 1 to 46½. The telephone group is somewhat easier; United River Plates fell ¼ to 8¼. In the Home list, International Automatic B have drooped to 42s. 6d., but Automatics hold their price at 55s. General Electrics, while nominally unchanged at 31s. 6d., have attracted support at that level. Metropolitan Vickers ordinary went ahead with an eighteenpenny rise to 28s. 3d. on account of the contracts which the company is known to be securing. Callenders improved to 48s. 9d. Siemens at 30s. 6d. are 9d. lower on the week. Business in the cable construction and equipment shares remains moderately active, but has become more of the investment type, the speculators being now busy with interests in other markets. Ever Ready shares touched 4½, and then reacted to 4¼.

Home Railway ordinary stocks are weak. This is due to the declaration by the Metropolitan Railway of a final dividend of 1½ per cent., making 3 per cent. for the year 1926, as against 5 per cent. in the previous twelve months. Anticipation had looked for a probable 4 per cent., and the announcement led to a fall throughout Home Rails. Metropolitans are 3½ points lower on the week, and Districts shed 10s., Underground Electrics also being dull.

The Mexican Utilities group has strengthened noticeably. News from Mexico—direct—suggests that the country is about to make a payment of interest upon certain of the Mexican Railway national bonds, and this brought about rises ranging from 1 to 3 points in Mexican Light and Power descriptions. Mexican Electric Light 5 per cent. bonds advanced to 58½. British Columbia Electric stocks further increased their values. Kalgoorlie Electric Power and Light shares gained a few pence at 5s. 3d. In the dollar stocks, Shawinigan common shares are 6 points better at 283½.

Fife Tramway Light and Power shares, which were standing at 16s., fell back to 12s. 6d. on the cutting in half of the previous dividend of 6 per cent. The report says that the power and lighting properties were seriously affected by the complete dislocation caused by the coal dispute in Fife, and that the transport department suffered severely from the unfavourable industrial situation during the last eight months of the year. The working costs and output of the two former sections are now, says the report, "almost back to normal conditions." It is significant to read that the Power Company's generating station is being interconnected with the Scottish Central Electric Power Company by a trunk transmission line. Holders of shares in provincial electric supply companies will note this with especial interest.

Rubber shares lack lustre and activity. The exportable allowance is reduced to 70 per cent. for the three months that start with the Tuesday in this week, but this failed to energise the market. Iron and steel shares lean to the lower side, Vickers easing off to 8s. 7½d., Armstrongs being 3s. 4½d. The prices of the best-class shares are well maintained, however, and Babcocks continue to be steadily absorbed by the investor who looks well ahead.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Jan. 31 1927.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14	14	609	—	4 13
Brompton Ordinary	£1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	£1	15	15	25/-	—	5 12 0
do. do. 4½ Pref.	£1	4½	4½	17/6	—	5 2 10
Chelsea	£1	12	12	25/-	—	5 12 0
City of London	£1	15	15	2½	—	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Clyde Valley	£1	8	8	28/6	—	5 12 4
County of London	£1	15	15	27/6	—	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	£1	7	8	26/3xd	—	6 2 0
do. 7% Pref.	£1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	£1	10	10	30/6	—	6 11 3
Kensington Ordinary	£1	15	15	24/-	—	5 16 8
Lancs. Light and Power	£1	7½	7½	24/-	—	6 2 6
London Electric	£1	10	10	24/-	—	6 17 8
do. do. 6% Pref.	£5	6	6	5½	—	5 11 7
Metropolitan	£1	11	11	28/-	—	5 7 8
do. 4½% Pref.	£1	4½	4½	17/-	—	5 2 10
Midland Counties	£1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	£1	7	7	20/-	—	7 0 0
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	£10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	17½	24/-	—	5 16 8
South London	£1	15	15	24/6	—	6 3 0
South Metropolitan Pref.	£1	7	7	1¼	—	6 3 9
Urban Ordinary	£1	4	7	1⅞	—	5 17 11
do. 6% Pref.	£1	6	6	20/6	—	5 17 1
Westminster Ordinary	£1	15	15	24/6	—	5 14 3
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	£1	8	8	27/6	—	5 16 5
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	5	66½	−3½	4 19 2
do. District	,,	8½	8½	66½	−½	6 4 0
Underground Electric	£1	Nil	Nil	13/-	—	Nil
do. do. Income	Bonds	6	6	104	—	*5 15 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	100½xd	+½	5 19 3
do. Def.	,,	1½	1½	9½	+½	6 3 9
Automatic Telephone	£1	8	10	22	—	8 12 9
Chili Telephone	£5	5	6	6½	—	4 13 4
Cuba Sub. Ord.	£10	5	5	7	—	7 5 6
Eastern Extension	£10	10	10	17⅞	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	174½	—	*5 14 7
Globe Tel. and T. Ord.	£10	10	10	18½	—	*5 6 6
do. do. Pref.	£10	6	6	11	—	5 9 1
Great Northern Tel.	£10	20	20	27	—	7 8 2
Indo-European	£5	9½	10	46½	−1	*5 7 6
Marconi	£1	10	Nil	15/-	−9d.	... ...
Marconi-Marine	£1	10	7½	1½	−⅛	6 13 4
Oriental Telephone Ord.	£1	12	12	2⅞	—	*4 18 4
United R. Plate Tel.	£5	8	8	8½	−½	*4 17 0
Western Telegraph	£10	10	10	17	—	*5 17 8
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	2½	—	9 15 6
do. do. 2nd Pref.	£5	6	6	2½	—	10 8 8
do. do. 5% Deb.	Stock	5	5	70½	—	7 1 10
British Electric Traction Ord.	,,	7	8	144½	—	5 10 9
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	£100	4	5	117xd	—	5 2 6
Brit. Columbia Elec. Ry. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	96/-	126/9	124	+1½	*5 1 11
do. do. Deferred	,,	129/6	8	153½	+1	*5 4 7
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	£1	2½	Nil	7/-	—	Nil
London United Tram. Deb.	Stock	4	4	43½	—	9 8 4
Mexico Trams. 5% Bonds	—	5	5	54	—	7 12 0
Mexican Light Common	£100	Nil	Nil	89½	+1	Nil
do. Pref.	£100	Nil	Nil	80½	+3	Nil
do. 1st Bonds	—	5	5	64½	+1	7 16 1
Yorkshire (West Riding)	£1	5	—	12/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	£1	12	18	53/9	—	4 16 8
British Aluminium Ord.	£1	5	10	48 3	−6d.	4 2 8
British Elec. Transformer Pref.	£1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	£1	15	15	70/-	—	4 5 9
Brush Ord.	£1	10	10	27/6	+9d.	7 5 4
Callenders	£1	15	15	3½	—	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£1	Nil	Nil	10/-	—	... ...
Edison-Swan	£/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	£1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	£1	7½	7½	1¼	—	6 6 4
English Electric	£1	5	Nil	15/-	—	... ...
do. do. Pref.	£1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 8
do. Ord.	£1	5	7½	31/6	—	4 15 3
Henley	£1	15	20	4⅞	+⅛	4 10 4
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	5	5	1	—	*5 0 0
Johnson & Phillips	£1	10	17½	9½	—	5 19 1
Met.-Vickers Ord.	£1	8	8	28 3	+1/8	5 13 3
do. Pref.	£1	8	8	2½	—	6 1* 4
Siemens Ord.	£1	7½	7½	30/6	- 9d.	4 18 4
Telegraph Construction	£5	20	10	22½	—	*4 9 8

*Dividends paid free of Income Tax.

High-Voltage "S.L."-Type Cables.

33,000-Volt Cables with Metal-sheathed Cores, each of which is Separately Lead-covered.

By P. DUNSHEATH, O.B.E., M.A., B.Sc., M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

(Concluded from page 154.)

In the next series of tests two lengths of steel-tape-armoured cable, one of the plain 3-core type and the other of the S.L. type, were buried in the ground at a depth of 2 ft. and subjected to steady loads in turn, each run being continued for several days to ensure ultimate conditions. The point at issue is illustrated in the comparative figures

TABLE I.

Cable.	Current, amps.	Temperature. Conductor, deg. C.	Outside surface, deg. C.	Rise, deg. C.
S.L. type ...	256	58.1	44.7	13.4
Plain 3-core ...	256	61.8	44.7	17.1

in Table I, from which it is evident that in spite of eddy-current losses in the sheaths the temperature-rise in the S.L. cable is less than in the plain 3-core cable. As the heating is proportional to the square of the current, under conditions in which the external thermal path has negligible resistance (with the cables lying in flowing water) the S.L. cable would have a current-carrying capacity of over 12 per cent. in excess of that of the plain 3-core cable. In order to simulate practical conditions, the cables were subjected to a variable load, and fig. 4 shows the variation of temperature in the two cables for the last three days. Throughout the run the S.L. cable remained considerably cooler than the plain 3-core cable.

In a more complete set of tests an experimental 75-yard length of 0.2 sq. in., 3-core, 33,000-volt, S.L.-type cable with a dielectric thickness of 0.34 in. and having the section shown in fig. 2, was tested. The main armouring is a double layer of steel tape, and over the individual cores is applied a coat of impregnated cotton tape for protection against corrosion and to form bedding. Laid out on the ground and covered with a few inches of earth to avoid the effects of air currents, varied d.c. up to 300 amperes was passed through the conductors, each run being maintained for 24 hours in order to reach steady conditions. The d.c. tests were followed by a.c. tests at 50 and then at 25 cycles.

Fig. 5 shows that no danger need be anticipated from the magnitude of these voltages; even if the effect on the pilots is considered, transposing at each joint would easily eliminate all interference. Fig. 6 shows that the magnitudes of the longitudinal sheath currents amount to about 7 per cent. of the main cable current. Fig. 7 demonstrates how insignificant are the sheath losses; even allowing for the less important sheath eddies not measured in this test, the total loss expressed as a percentage of the copper loss at the full working current of the cable is only of the order of 3 or 4 per cent. Comparison of the values in figs. 8 and 9 is illuminating as it shows the negligible heating effect of the sheath losses (the outside surface being maintained at 20 deg. C.); the temperature rises under a.c. conditions are only very slightly higher than those under d.c. conditions. In order to obtain a straightforward assessment of the S.L. type, it must be credited with the advantage of the cooling due to the sheaths, as well as being debited with the additional heating caused by them. In fig. 10 are given the sheath and conductor temperatures for various 50-cycle currents noted in a load test on a 200-yard length of 0.2 sq. in., plain 3-core, single-wire-armoured, 33,000-volt cable. The important comparison to show up the merits of the S.L. cable is between figs. 9 and 10; if both cables were laid in water, the S.L. cable for the same temperature rise would carry 14 per cent. more current than the plain 3-core cable.

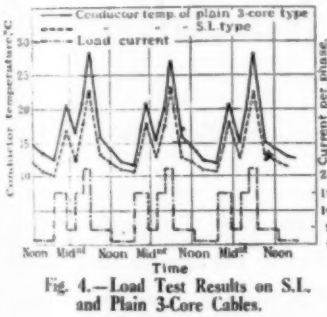


Fig. 4.—Load Test Results on S.L. and Plain 3-Core Cables.

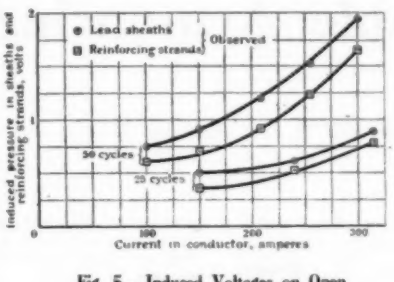


Fig. 5.—Induced Voltages on Open Circuit, S.L. Cable.

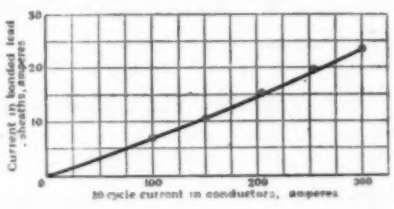


Fig. 6.—Longitudinal Sheath Currents, both ends Bonded.

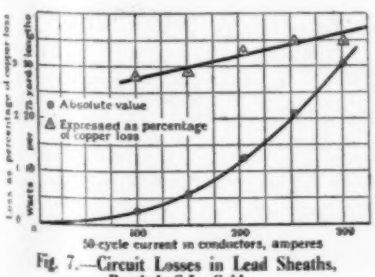

Absolute value
Expressed as percentage of copper loss
Loss as percentage of copper loss
50-cycle current in conductors, amperes

Fig. 7.—Circuit Losses in Lead Sheaths, Bonded, S.L. Cable.

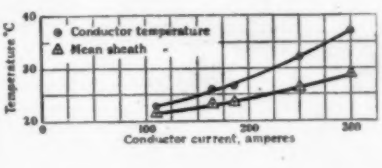


Fig. 8.—D.C. Heating Tests, S.L. Cable.

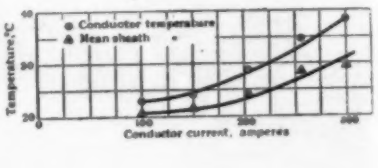


Fig. 9.—A.C. Heating Tests, S.L. Cable.

In order to obtain a still more practical comparison, heating tests have been carried out on three 50-yard lengths of 0.2 sq. in., 33-kV cable, a plain 3-core cable, an "H"-type cable and the S.L. type; the same paper and compound were used on all three, and the same manufacturing process adopted in all. The results are briefly summarised in fig. 11, which show the ultimate temperatures attained by the conductors.

Full appreciation of the merits of the S.L. construction for 33-kV transmission raises the question of using single-core

cables for the same purpose. If they can be laid in triangle formation close together, there is no reason why the losses with single-core, lead-covered, unarmoured cables should be any greater than those with the S.L. cable. From the point of view of mechanical protection, the S.L. cable can be laid direct in the ground as manufactured; the use of single-core, armoured cables for a.c. transmission is impracticable both from the point of view of losses and that of current-carrying capacity, and their use in place of S.L. cables for 33-kV systems must allow for at least equal mechanical protection. As regards convenience, small single cores are admittedly easier to handle, but this ease is a danger; the less a super-voltage cable is bent during laying the better are its chances of a long life. Whenever single-core cables are used, interference with external telegraph and telephone circuits must be watched. The cores in the S.L. type are twisted together with a lay of only a few feet, while the equivalent single cores are laid together side by side without any twist; therefore, with the former interference would be absent, while with the latter it might be very pronounced.

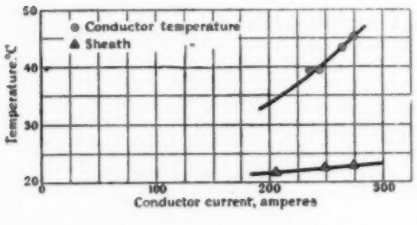


Fig. 10.—A.C. Heating Tests, Plain 3-Core 33-kV Cable.

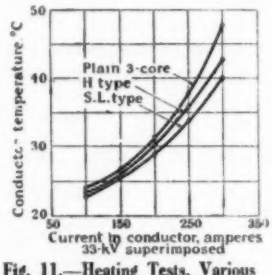


Fig. 11.—Heating Tests, Various Loadings and Types of Cable.

Comparison of a number of cases of different sizes shows that, taking into account the cost of cable, excavation, laying, jointing and reinstatement, the advantage is with the S.L. cable. A single-core installation for the same thickness of dielectric costs slightly more than an S.L. installation. If pilots be included in the comparison, the advantage in favour of the S.L. type may amount to as much as 6 or 8 per cent. on the cost.

The general conclusions are that metal-sheathed-core cables have many important advantages over plain 3-core cables, and practically no disadvantages. Of the two types, the S.L. has important advantages, but has been considered to have disadvantages because of the voltage generated and losses incurred in the sheaths surrounding the separate cores. A wide range of tests shows conclusively that these fears are groundless. The voltages are very small, even when not suppressed by bonding, and when the cables are bonded together the losses due to eddy currents are negligible. Also, contrary to the previous supposition that the losses reduce the rating of the cable by the heat generated in the sheaths, the cooling effect of the sheaths carries the balance far in the opposite direction, resulting in the S.L. type of cable running very much cooler than the plain 3-core cable. Considering also that the S.L. cable is lighter in weight than the plain 3-core cable and carries with its use a very simple joint construction, in addition to the known electrical advantages, it seems that an unanswerable case is made for its use as a solution of the 33,000-volt cable problem.

A Large Cable Armouring Machine.

50-h.p. Plant Made and Recently Installed by Messrs. Johnson & Phillips, Ltd.

THE accompanying illustration shows a large cable armouring machine which has recently been installed in the paper cable shops of Messrs. Johnson & Phillips, Ltd. It is some 220 feet long, over all, and is intended to armour cables with outside diameters up to 5¼ in. Two armouring cages containing 96 floating bobbins and 24 fixed bobbins, each measuring 18 in. by 9 in., provide for serving the cable with 120 wires in all. The capacity of each bobbin is about 3¼ cwt. of wire. The jute is served by means of six disks, each carrying 64 spools of the material. There are ten compound tanks, which are provided with special exhausting gear for the removal of the fumes. The machine is also arranged for steel-tape as an alternative to steel-wire armouring. The diameter of the draw-gear wheel is 9 ft., and the take-up stand will receive drums up to 12 ft. in diameter and from 15 to 20 tons in maximum weight.

The drive is by a 50-h.p. centrally placed motor directly coupled, through friction-clutch gear, to the main shaft, an arrangement which enables the heaviest load to be picked up gradually and easily. The wire cages run on ball bearings, and are provided with a loading gantry. The two wire sections can be coupled together by means of a coupling tube and the centre serving plant removed, the cages being synchronised so that the 120 wires can be put on in one layer if required. It is of interest to learn that the machine was manufactured entirely in the Johnson & Phillips' engineering shops.

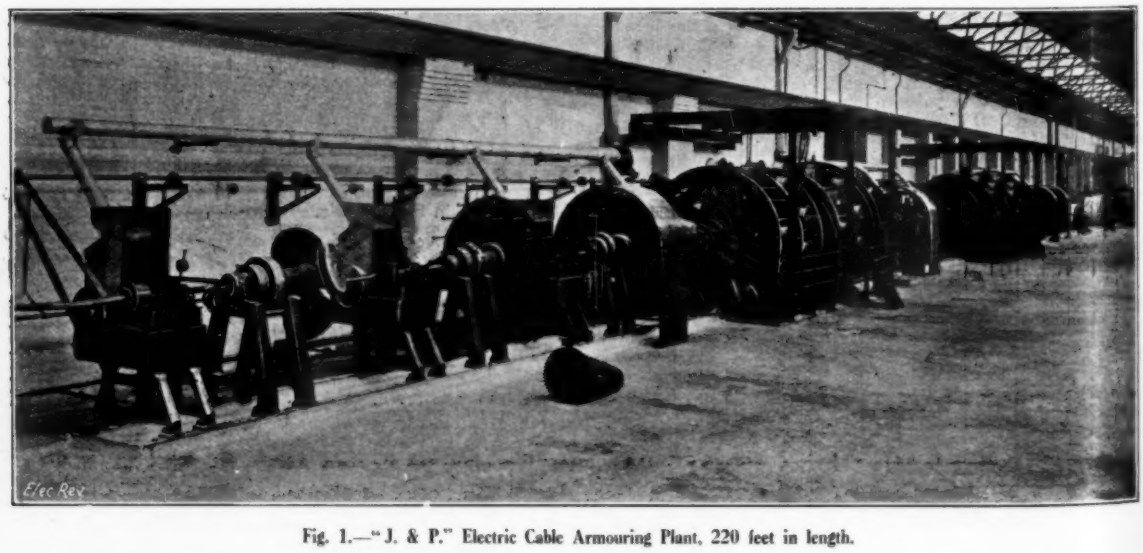


Fig. 1.—"J. & P." Electric Cable Armouring Plant, 220 feet in length.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Concluded from page* 153.)

Klaxon, Ltd.

The Company's chief exhibit was the "Audiwave" used for applying the new Eldred method of relieving deafness. The machine's action is the same in principle as that of the radio loud-speaker; in front of it is a rigid vibrating cone which is operated by mechanism similar to that of an electric bell, but designed to produce vibration of the required characteristics. The instrument is driven off a 6-volt battery, and a rheostat controls the amplitude of the vibration, this quantity being indicated simply by a mark on the cone. Patients may apply the treatment themselves at home.

New Oscilloscope Co., Ltd.

Improved models of the Elverson oscilloscope, or flashing-lamp stroboscope, are more robust and compact than the earlier ones; in addition to the usual method of operation by direct connection to mechanisms to be examined, the new types can be used for cursory examinations in exactly the same manner as hand tachometers, the oscilloscope gear-box being held in one hand and the lamp for the examination of the mechanism in the other hand.

The vibrating-wire stroboscope, by Prof. A. Guillet, is a new form of stroboscope, which has a field of utility supplementary to the oscilloscope, and can be used for quantitative tests on various electrical applications besides its utility in instances of tests on mechanical plant where it may not be convenient or possible to obtain a direct connection (and thus absolute synchronism) between the stroboscope and the mechanism to be examined. The instrument is suitable for tests at all frequencies or speeds from 1,000 to 12,000 r.p.m., and is compact and easy to operate. In principle, it consists of a metal strip of wire, the vibration of which is sustained electrically by means of a small electromagnet suspended over its centre and actuated by the current from a small battery; the current is cut off by the wire itself at the moment of its passing through the position of equilibrium. The frequency of vibration of the wire can be regulated by imperceptible degrees, through varying its tension by means of a screw on which is engraved an accurately divided scale. This vibrating wire opens and closes the primary circuit of an induction coil, across the secondary of which is connected a special form of neon lamp, the flashing frequency of which coincides exactly with that of the cord, and thus it is possible at any moment to follow the movements of a mechanism.

Radio Communication Co., Ltd.

This exhibit consisted of an automatic signal call device; a continuous-wave radio transmitter with an input rating of 1.5 kW, of the standard type for wave-lengths of from 500 to 3,000 m.; and a "Polar Four" broadcast receiving set, consisting of a detector and three resistance-capacity coupled l.f. stages, the outfit having been designed for operation by a simple method of remote control.

Other Exhibitors.

Other exhibitors in the trade section of the show included the Zenith Electric Co., Ltd. (resistances and rheostats). R. M. Catterson-Smith and K. S. Mills (electric resistance laboratory and other furnaces). Damard Lacquer Co., Ltd. ("Formite" and "Bakelite" synthetic resin products). Darimont Electric Batteries, Ltd. (two-fluid primary cells). W. Edwards & Co. (vacuum pumps, cathode-ray oscillograph, photo-electric cells, quartz mercury-vapour lamps, and other laboratory apparatus). A. Gallenkamp & Co., Ltd. (electric furnaces, electro-titration apparatus, &c.). Gambrell Bros., Ltd. (cable and other testing apparatus, fire-alarm call box, and wireless gear). John J. Griffin & Sons and Baird and Tatlock, Ltd. (calorimeters, CO_2 indicators, laboratory ovens, oil-testing and other measuring instruments, pyrometers). The India Rubber, Gutta Percha & Telegraph Works Co., Ltd. (telegraph apparatus and wireless accessories). Isenthal and Co., Ltd. (resistances and motor mercury starters, automatic voltage regulator, regulating transformer, &c.). Kelvin, Bottomley & Baird, Ltd. (quartz mercury-vapour lamps, and artificial daylight lamps). P. J. Kipp & Zonen (optical and electrical instruments). Laboratory Equipment Co. (electric lamps). Baird & Tatlock (London), Ltd. (electrometric titration apparatus). W. H. Pettifor (electrical aids for the deaf). W. G. Pye & Co. (electrical laboratory apparatus). Schall & Son, Ltd. (high-voltage transformer for X-ray research on crystals, which is also useful for cable testing). Venner Time Switches, Ltd. (street-lighting automatic switches).

Research and Experimental Section.

Group A of this section was representative of typical results of recent physical research of general interest, and examples of new or improved laboratory methods.

Amongst the 19 exhibitors, the British Photographic Research Association showed a phonometer for the measurement of the opacity of photographic negatives. The selenium cell used in the original instrument has been replaced by a special gasfilled photo-electric cell, constructed by Mr. T. C. Keeley, of the Clarendon Laboratory, Oxford. The current is magnified by means of a valve and recorded by a comparatively insensitive galvanometer which is extremely dead-beat and very quick in action. In order to obtain sensitivity, the whole of the light which passes through the negative is collected by the photo-electric cell, the negative being placed in contact with the cell window; this creates a practical difficulty, in that usually the comparison beam (which passes through the calibrated optical wedge) enters the cell through the same window. The difficulty is overcome by providing a second window, so that the two beams enter the cell at right angles to one another.

Amongst the Admiralty Research Laboratory's exhibits was a sub-standard for the determination of frequencies above the range of tuning forks. A metal rod, set into longitudinal vibration by a blow on one end, emits sound waves which influence a microphone placed near the other end; the alternating current whose frequency is to be measured flows through the microphone, and a note is heard in a telephone receiver connected in parallel with the microphone, having a frequency which is equal to the difference between the rod and current frequencies, which can be measured by means of a sonometer.

For the determination of the strength of wireless signals on wavelength greater than 6,000 metres, a meter was shown which is operated thus: a small e.m.f is introduced periodically into the aerial circuit, and its magnitude and frequency are altered till the signal is matched.

The Air Defence Experimental Establishment (Major W. S. Tucker) had an instrument on view for training sound locator operators indoors, *i.e.*, where actual aeroplane flights are impracticable. It consists of an addition to the ordinary sound locator whereby a.c. is produced in telephones worn by the operators. When the trumpets are manipulated, the phase displacements between these currents are altered, and the operators experience binaural sensations, whereby they are enabled to point the locator at a dummy target running on a track.

Mr. J. L. Baird's model of the transmitting portion of his original "television" apparatus was lent by Messrs. Television, Ltd.

Prof. W. Cramp's magnetic balance for measuring field intensities is capable of reading below 50 lines per sq. cm., and is based on the principle of balancing by a weight the force which deflects a short conductor carrying a current and placed in a magnetic field.

The research laboratories of the General Electric Co., Ltd., demonstrated a circuit devised by Boucherot, which gives a constant-current supply from a fixed a.c. voltage supply: an inductance and capacity were connected in series across the mains and tuned to the supply frequency, the load being connected across either the inductance or the capacity. The network has the remarkable property that the current through the load is entirely independent of the load impedance; in contrast with a constant-voltage supply, the load terminals may be safely short-circuited, but may not be left open-circuited.

Other items included a sensitive electroscope, the moving system of which consists of an inverted loop of tungsten wire of such length in proportion to its other dimensions that it is nearly unstable, so that the restoring force is made very small: the use of tungsten wire allows the moving part to be made very light, so that air damping is effective, and sensitivity may be controlled by rotating the instrument. A machine which enables the voltage rating of electric lamps (gasfilled or vacuum) to be determined automatically and rapidly to a high degree of accuracy employs colour matching by means of two photo-electric cells, one being more sensitive to red light and the other to blue; vacuum lamps can be rated with a mean error of 0.13 per cent. in voltage at a rate of about 200 per hour. In a sector photometer designed for the rapid measurement of polar distribution of large lighting units or light sources, a Lummer-Brodhun contrast head is used, and the brightness of the comparison field is controlled by a stationary variable aperture sector and rotating prisms.

as in the Weber photometer. The photometer and mirror gear can be so arranged that a single observer can make all necessary adjustments, and take all readings.

The structure of opal glass was illustrated, and apparatus for determining the absolute expansion coefficient of glass. Three specimens showing stages in the making of the flat annular hard-glass type of photo-electric cell were on view; also electric ovens of a type developed for use particularly in the pumping of large valves of light weight and very low heat capacity for their size.

Mr. A. F. Hallimond's contribution was a magnetic separator for research on powdered minerals, rocks, &c.

In the Henley Research Laboratories (Capt. P. Dunsheath) a covering power tester has been devised for the purpose of discriminating between one yarn and another from the point of view of the manner in which a given quantity of the yarn will cover a wire; the principle of the machine consists in winding the yarn to be tested on to a rotating mandril with a continuously varying pitch, the gear ratios of the machine fixing the pitch at the moment that the yarn just covers the mandril. A machine has been designed to compare the softness of any particular sample with the softness of perfectly annealed wire: by the release of a fixed spring load, a centre anvil deflects the wire through an amount given by the dial indicator, which is a direct measure of the softness.

One of the most important tests of an insulating oil is its electrical breakdown, and the apparatus used in the Henley Research Laboratories for this purpose was shown. One of the samples illustrating the breakdown of impregnated paper under electric stress indicated the combination of the tangential discharge on two opposite sides of a sheet connected by a puncture through the paper. The cheeselike formation found in certain insulating oils used for impregnating paper cables, when subjected to prolonged high electrical stress, appears to be a highly polymerised product of certain constituents of the oil, and is quite inert. Apparatus has been in use for some time for testing this property of impregnating oil, a sample of the substance being subjected to a high dielectric stress between two electrodes.

Dr. E. W. Marchant's apparatus for comparing the conductivities of metal plates and for determining flaws in metal surfaces was exhibited.

The Metropolitan-Vickers Electrical Co., Ltd. (Research Dept.) exhibits were illustrative of the "shortpath" principle of thermionic valve construction, which gives reduced ionisation and low impedance. A molybdenum-wound resistance furnace which can be operated up to 1,800 deg. C. was shown, in which a hydrogen atmosphere is used.

The National Physical Laboratory's many exhibits included a demonstration of the production of standard telephonic frequencies directly from the seconds given by the pendulum of a clock (Mr. D. W. Dye):—(*a*) A tuning-fork, adjusted to a frequency as nearly as possible 50 cycles per second, was provided with an electromagnet; impulses of current through the magnet, caused each second by a contact on the pendulum, maintained the fork in vigorous vibration at its frequency of exactly 50 cycles per second. (*b*) A two-valve "multivibrator" provided sudden impulses of current at intervals of 1/50th of a second, which were kept rigorously uniform in rate by the tuning-fork. (*c*) The impulses provided by the multivibrator maintained oscillations in a tuned resonant circuit, which could be adjusted to any frequency within limits; whenever the frequency had a value which was an integral number of times that of the impulses, large forced resonant oscillations of this exact frequency were built up and maintained.

The British Thomson-Houston Co., Ltd. (Engineering Laboratory) had a model which represented mechanically the electrical action in an oscillating valve circuit. The Company also showed how, by the use of a gasfilled photo-electric cell working at its ionisation point, rapid determinations of the percentage flicker of light emitted from lamps on a.c. circuits can be made. The lamp under test is fed at normal voltage, and the light intensity reaching the cell is adjusted (by diminishing the distance) until the cell suddenly ionises, and a large increase of current occurs; this point is very sharp and well defined. The lamp voltage is carefully observed at this point; d.c. is then substituted for a.c., and the voltage slowly raised until the ionisation point is again reached: from the relative voltage readings the variation in light may be calculated.

The effect caused by the liberation of a dose of tungsten vapour into an argon discharge tube was shown, using a type of discharge described by Dr. Langmuir. The tungsten vapour thus produced caused the discharge to pass through a characteristic series of changes.

Models.

Group B of the experimental section, which consisted of some eleven exhibits, was intended to illustrate some little-known and effective lecture experiments of interest to teachers of physics. Amongst the items on view were the following:—

Mr. G. G. Blake, a model designed to illustrate the action of a three-electrode valve, employed for instructional purposes by the Royal Air Force.

Mr. A. E. Bowyer-Lowe, a model for demonstrating beat notes in connection with super-heterodyne wireless receivers: it consisted of six organ pipes.

Prof. G. B. Bryan showed a valve-characteristic model designed by Prof. C. L. Fortescue for the purpose of showing the relationship between three independent variables of a thermionic valves, *viz.*, grid voltage, anode voltage, and anode current.

Prof. W. Cramp, apparatus for the measurement of capacity by analogy.

Mr. J. F. Gill's model illustrated the principle of synchronous and induction motors.

Dr. Edward Hughes, a model for demonstrating three-phase currents, the whole arrangement being mounted so that it can be placed in a projector instead of the usual slide carrier.

Mr. J. Paley Yorke's models for use of teachers assist in demonstrating some of the fundamental principles of magnetism and electro-magnetism, designed for projection by means of a demonstration lantern; also some working models demonstrating the principles of some instruments.

Mr. L. G. Vedy and Mr. G. Gowlland demonstrated the rotation of bodies with dielectric surfaces in electrostatic fields: the bodies are usually charged during rotation, and the phenomenon appears to be due to the effect of the discharge on the non-conducting surface layer.

In Group C, famous historical experimental apparatus was shown.

Electrical Notes from Canada.

The Development of Power on the River St. Lawrence.

[By Our Special Toronto Correspondent.]

THE outstanding event of recent weeks has been the presentation of the report of the Joint Engineering Board appointed in 1925 by the Governments of Canada and the United States to report on the feasibility of developing the St. Lawrence River for both navigation and power. This report reveals that the engineers representing the two countries are fully agreed as to the desirability of making use of this great waterway for both purposes, but on the question of how the power development should be carried out they differ. Their attitude with regard to the latter is unfortunate for it will no doubt cause considerable delay.

The situation is a little peculiar in that the works necessary to provide a deep waterway for navigation will, unless they are to be ineffective for some years, have to be carried out on the whole stretch of the river from Lake Ontario to Montreal, a distance of 183 miles, which includes the international section of the river and a portion which lies entirely within Canada. The United States is, of course, vitally interested in the entire scheme, since it would provide both countries with an outlet to the sea for ocean-going ships. On the other hand, so far as power development is concerned, while the two countries must work together on the international section, the all-Canadian portion has nothing to do with the United States.

It is interesting to note from the report of the Joint Engineering Board that navigational works carried out in conjunction with power development will be less costly than if carried out alone, so that not only will the power development be a source of revenue, but it will actually be the means of reducing the capital cost of the navigational works. The report states that there will not be more than 25 miles of canal navigation and not more than nine locks and eight bridges, and that the waterway can be kept open for traffic during eight months each year—ice, of course, will close it for the other four months.

The Canadian engineers believe that it would be better to build two dams and develop power at two different sites, while the Americans favour a single dam and the utilisation of the entire available head at one site. The advantages of the Canadian plan appear to be that considerably less land would be flooded, that power could be made available in about three years' time, instead of six, after the date of actually commencing work, and that although the capital cost would be higher this would be offset, at least to some extent, by the fact that the interest charges during the construction period would be less. The disadvantages are that not only would the total capital cost be somewhat higher than for the American scheme, but the actual power made available would be slightly less.

Another difference in the views held on the two sides of the river, though this is not a matter dealt with in the above-mentioned report, is that, so far as the development of power on the international section is concerned, public ownership is favoured in Ontario and private ownership in the United States. This fact may possibly introduce some difficulties in the two countries arriving at satisfactory agreements for the carrying out of the work which would not exist if both sides favoured the same plan of ownership.

Further progress towards the realisation of this great project has just been made by the issuing of a report by the St. Lawrence Commission, some details of which have appeared in the daily Press. This body, with Mr. H. Hoover as chairman, was appointed by the Federal Government of the United States to consider the several proposals which have been made to provide outlets to the sea, and to report which it considered to be the best. The Commission's report favours the St. Lawrence route.

The other proposals referred to had many supporters in New York State. One of these, known as the "All-American" route, involved the construction of a great system of canals linking the lower end of Lake Erie with the Hudson River. The other scheme would have run from the eastern end of Lake Ontario to the Hudson River. It is said that each of these would have been much more costly in construction, and also in maintenance, than the St. Lawrence scheme.

Before leaving this subject, some figures given out by a prominent American engineer and quoted in the Canadian *Electrical News* may be of interest. In the distance (120 miles) between Lake Ontario and Montreal, the St. Lawrence River falls 220 ft., carrying all the discharge water from the Great Lakes system, which comprises 200,000 sq. miles of catchment basin, of which 90,000 sq. miles is lake area. The present shipping, representing about 6,000,000 tons of freight, can be increased to about 100,000,000 tons per annum—this will greatly lessen the cost of shipping grain from the immense wheat-growing areas of the west. The St. Lawrence will produce about 5,400,000 h.p., 1,200,000 h.p. of which will belong to the United States and the rest to Canada.

From the foregoing, it is easy to realise why Canadians, and particularly those in Eastern Canada, take such an interest in the question of the St. Lawrence River development.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A 'Bus Lighting Lamp.

A recent development of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is the production of the internally frosted "Pearl Osram" lamp for the interior lighting of 'buses. The outer surface of the lamp is quite smooth so that it can readily be cleaned with a duster. Compared with the clear lamp the new model has many advantages claimed for it, one of the chief being that its enclosure in globes or well-glasses is unnecessary. In this respect it is interesting to learn that the G.E.C. recently carried out certain tests to ascertain the amount of light lost by and through the use of various forms of well-glasses. It was established that a thin, clear well-glass absorbed as much as 8 per cent.

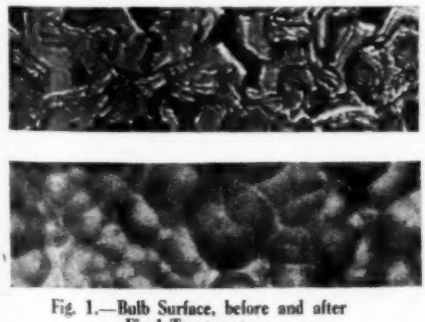


Fig. 1.—Bulb Surface, before and after Final Treatment.

Fig. 2.—"Pearl" Osram 'Bus Lamp.

of the light emitted from the lamp, and that an elaborate pattern of opal well-glass was responsible for a loss of light of approximately 40 per cent. These tests resulted in a decision by a 'bus company to use the internally frosted lamp, which, it is claimed, absorbs scarcely 2 per cent. of the light emitted from the filament, with efficient diffusion. The first process employed for internally frosting lamps made the bulb so fragile that it was unfit for practical lighting purposes. The method weakened the wall in the same way as a metal bar is weakened by notching it with a file. The acid used for internal frosting, by its chemical action, actually cuts innumerable notches in the glass. It is a well-known fact that a notched metal bar increases in mechanical strength when the notches are filed down until they disappear. A somewhat similar principle is employed for the lamp frosting, the sharp grooves cut by the acid being rounded off by a further acid treatment. Fig. 1 shows photo-micrographs of the internal surface of a bulb before and after the second acid treatment, the latter or lower illustration being highly magnified. Fig. 2 shows the "Pearl" 'bus lamp.

An Electric Iron Safety Stand.

With a view to the prevention of fires or other accidents due to the overheating of an electric iron, Messrs. BRUCE, DAWSON & Co., 70, Finsbury Pavement, London, E.C.2, have recently placed on the market their "Itur" safety stand, fig. 3. This is in the form of a convenient iron rest of a similar shape to that of the iron itself, and carries an internally arranged switch which is operated automatically to the "off" position by the depression of the top plate, under the influence of the weight of the iron. The supply to the iron is taken through the stand switch, suitable inlet and outlet connections being provided. If it is desired that the current should remain on, the iron is placed crosswise on the stand so as not to depress the top plate. The standard article is suitable for all makes of electric iron and for any of the voltages in use. Practice has shown, it is claimed, that the use of the device has resulted in a considerable saving in energy.

Fig. 3.—Electric-Iron Safety Stand.

An Electric Bedwarmer.

The "Thermal" electric bedwarmer, fig. 4, is a recent production of the LONDON AND RUGBY ENGINEERING CO., LTD., 36-7, Queen Street, London, E.C.4. It is made for voltages of 100/110 and 200/250, and consumes 300 W. It is not intended for connection to the supply during use, being capable, it is

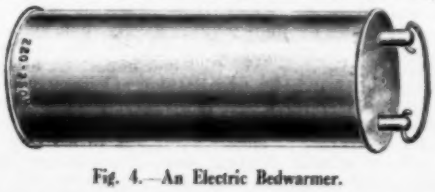


Fig. 4.—An Electric Bedwarmer.

claimed, of retaining its heat for from 6 to 8 hours after being "on circuit" for only 10 minutes. It is suitable for use in other connections where local warmth is required. It is 9 in. long by 3¼ in. wide, and has a nickel-plated finish.

A New Electric Geyser.

The accompanying illustration, fig. 5, shows a recent addition to the "Gee-Gee" products of Messrs. GEORGE GREEN AND CO., 40, Aybrook Street, London, W.1, the instantaneous geyser. It is constructed of cast aluminium, and is complete with a swivel spout and lugs for wall fixing. The heating equipment is enclosed in tinned-copper sheaths and is entirely electrically insulated from the water. To comply with the I.E.E. regulations, the switch is arranged as a separate unit, and has been so combined with the cold water inlet valve that it can only be "on" when the water is running. The construction and finish of the apparatus gives it an attractive appearance.

"Morganite" Heaters.

Since the general description of the "Morganite" resistor and its applications in our issue of June 13th, 1924, p. 958, the MORGAN CRUCIBLE CO., LTD., Battersea Works, Church Road, London, S.W.11, has developed several models of wall and floor radiators. Fig. 6 shows a "Morganite" imitation luminous heater which has been designed to produce the psychological effect of a glowing fire, while preserving the essential feature of low-temperature radiation. The result is achieved by concealing lamps within a sheet-metal scroll which reflects the light on to the glazed or coloured surface of the heating element. The wall-fixture radiator shown in fig. 7 is particularly suitable for public halls, dining rooms, and so on, the mounting being ornamental and self-contained, while a guard in front of the element can be supplied in various designs to suit different styles of decoration.

Fig. 5.—A Modern Electric Geyser.

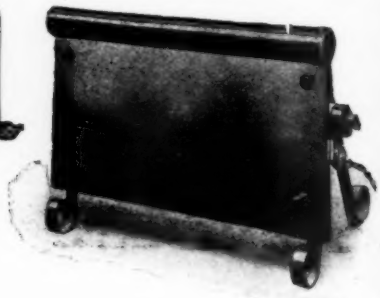


Fig. 6.—Imitation Luminous Heater.

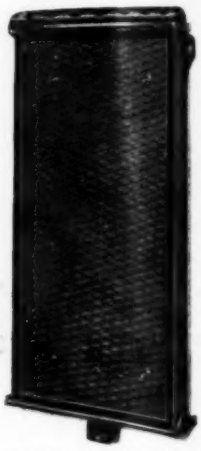


Fig. 7.—A Wall Radiator.

Industrial Electric Heating.

The Fourth E.D.A. Salesmanship Conference.

MR. R. W. L. PHILLIPS (electrical engineer to the Bedford Corporation and president of the I.M.E.A.) was in the chair at the conference of the Electrical Development Association, on Friday, January 21st, when Mr. S. E. Monkhouse, of the Newcastle-upon-Tyne Electric Supply Co., Ltd., read a paper on the above subject.

Mr. MONKHOUSE said that as a first step in the direction of developing this class of load, the Newcastle Company had detailed an engineer some months ago to deal exclusively with industrial electric heating, and, as a result of his efforts, Mr. Monkhouse was convinced that considerable propaganda was necessary if the business were to be stimulated with the minimum of delay. He disagreed with the view that industrial heating business would be developed only if electricity were sold at a price which was competitive on a heat basis with that for other classes of fuel. To develop the business with profit supply engineers would require to discriminate between a competitive price on a heat basis and an economic price, between which there was a great difference; there was always a market for the superior commodity. Many cases had come to his notice during the last few months where processes could be dealt with more efficiently and completed more economically by employing electricity than by employing other media, after paying a price remunerative to the supply authority. The author said that one important feature of a furnace heated electrically was its high efficiency when working at high temperatures. At temperatures round about 2,400 deg. F., gas, coal and oil had efficiencies of from 10 to 20 per cent.; in the case of electricity it was 75 per cent. Other advantages of electric heating were close temperature control; the ability to apply heat just where it was wanted, avoid cold spots, and arrange the rate of heating to suit the process; the absence of fumes and soot; automatic stopping and starting; elimination of coal- and ash-handling and banking losses; uniform rate of heating; and reduced maintenance costs, owing to the absence of corroding fumes and the scouring action of gases. There were numerous installations of electrical heating processes in operation in this country, and it was a matter for regret that the existence of those installations was not made more generally known to the manufacturers. To illustrate the variety of purposes for which electricity had been applied in this country, the author mentioned steel annealing, linseed-oil burning, bitumen heating, paint drying, vacuum drying ovens, and many other uses. He also gave a list of typical installations in operation in the United States, giving a comparison of the cost when using electricity as compared with the fuel used previously, as well as the reasons why electric heating was adopted. This produced many points in favour of electricity.

One direction in which he considered a development might be expected was in the application of electricity for the heat treatment of colliery drills and coal-cutting picks used in mechanical coal cutters; it seemed probable that in the future it would become common practice for each colliery where coal cutters were employed to have a furnace in which to treat the cutting tools periodically. Many mines in South Africa were already so equipped. Another application of electrical industrial heating might be cultivated in works where a small quantity of steam was required intermittently in different parts of the factory. In such cases, if independent electrically heated steam-raising boilers were installed, a saving in cost would result, first because the cost of providing and maintaining long lengths of steam pipes could be avoided, and secondly, for the reason that steam could be raised quickly as and when required, and need not be maintained constantly. There were a few installations in operation in this country in which the circulating water for heating large buildings was heated electrically during off-peak hours, a system of thermal storage being provided for maintaining the water at the required temperature during the day. The Newcastle Electric Supply Co. has this system in operation in one of its buildings, and it was being installed in another now in the course of erec-

tion. In both cases an electrode system of heating was employed, and the high pressure supply was used without resort to transformers. The demand made by these installations was 800 kW and 1,800 kW, respectively.

A recent important development was an apparatus which made use of high-frequency currents for the production of intense local heat. Many furnaces of this type were already in operation in this country, and very high temperatures were being obtained with considerable accuracy. The frequency usually adopted was 25,000 cycles per second, but in one case a frequency of 50,000 cycles per second was being used for heating a material having a comparatively high resistance.

With regard to the conversion of existing heating appliances, he said that so far as technical considerations were concerned he was in sympathy with the view held by competent engineers that this was not a practice to be recommended. From a commercial point of view, however, he felt that there was a good deal to be said against it. It was a question for serious consideration within the industry as to whether every effort should not be made to meet the users' dictates in this connection. Conversions might be troublesome to effect, and might lead to indifferent efficiency, but if they provided a means for encouraging the adoption of electricity for heating purposes, surely they were justifiable. He had heard of cases where considerable ingenuity had been shown by the engineering staff of various works in converting steam and other heating apparatus to electricity; it was doubtful whether all or any of these would have been working electrically to-day if it had been necessary to discard the whole of the existing equipment. As an example he mentioned a case in which, in order to overcome the cost involved in maintaining steam at night for the purpose of heating a large vacuum drying oven, the steam pipes were insulated from the oven and a current passed through them from the secondary of a special low-voltage transformer, so that the oven was heated during the day by steam and at night electrically, and considerable saving had been effected.

In conclusion, Mr. Monkhouse said that the industry would benefit greatly by an active publicity campaign on behalf of industrial heating.

Discussion.

Opening the discussion, Mr. T. SETTLE (General Electric Co., Ltd.) said that while, so far as he knew, the Newcastle Electric Supply Co. was the first and only supply authority in this country to appoint a qualified engineer to deal with electric heating problems, in the United States a very active policy had been adopted. Lectures were given, to which everybody interested in industrial heating was invited. As electric heating, when using apparatus of the resistance furnace type, had an inherent high power factor, and often a high load factor, it might appeal to the Electricity Commissioners to appoint a committee to deal with industrial heating. His own company had decided to go in wholeheartedly for developing industrial heating, and proposed to install electric ovens in some of its own works in order to convince intending users that satisfactory results could be obtained under practical conditions. In the United States he had seen works in which electric furnaces were used for enamelling watch dials in large quantities, for the coating of pipes with asphalt, for softening bakelite for moulding purposes, electric sherardising ovens, ovens for coating wires with enamel, and plant for electrically sterilising milk cans, &c. The water heating problem was entirely in the hands of the supply authorities; everything depended upon the rate charged for energy. If the future lay entirely with "off-peak" load, that would lead us automatically towards thermal storage. The conversion of existing apparatus would not, in the majority of cases, justify the trouble and expense involved.

Mr. F. W. LEEVERS (British Thomson-Houston Co., Ltd.) drew attention to a few of the difficulties in the way of industrial heating. There was first the question of capital cost, and if there was difficulty in getting firms to go in for complete new plant, then the conversion of existing apparatus should be advocated. Then there was the cost of operation, which called for the collaboration of the supply authorities, and in this connection the better quality of product in industrial processes when electricity was used should be stressed to the manufacturer. Finally, there was the psychology of the user, which meant that some sort of guarantee as to results must be given by the manufacturers.

Mr. H. MARRYAT (Messrs. Marryat & Place) said that the better quality of the product with electric heating in some industrial processes was so great that competition hardly entered into the question. There were other applications, however, in which other fuels could do the work practically as well, and there was a large field in this direction. There the cost of energy was important. A case in point came before his notice recently when a proposal was made to a supply authority for a 20-hour load with four hours off for what was conceived to be the peak. Unfortunately the rate quoted was such that the transaction fell through. No mention had been made of spot welding, but there was a large amount of work to be done in displacing the riveting and seaming in shipbuilding.

Mr. H. T. SULLY (Marylebone) referred particularly to water heating, and said that in Switzerland there were installations using up to 10 million kWh per annum for this purpose, the rate being extremely low. As another special application of electric heating he mentioned the new reptile house at the Zoo, where the consumption would ultimately be two million kWh.

Mr. H. J. ADAMS (Metro-Vick Supplies, Ltd.) spoke of the large extent to which electricity was used for steam raising in Canada, Newfoundland, and the United States, especially in paper mills.

Mr. R. D. GIVEN said he had gone into the question of steam raising by electricity, but had found that unless the rate was exceedingly small it would not pay. The policy in Canada was for the hydro-electric plants to sell their excess energy at exceedingly low rates on the understanding that the amount would be reduced at short notice if an ordinary customer came along.

Mr. LESSERS (City of London Electric Lighting Co., Ltd.) said that architects designed buildings so that 80 per cent. of the heating was by central heating from fires, leaving only 20 per cent. for electric heating. That did not give a good load factor. His company had special rates for water heating.

Mr. J. W. BEAUCHAMP (E.D.A.) said there were many installations of industrial heating of which no information was published, and he asked manufacturers and others not to keep this to themselves, but to let the technical Press or E.D.A. have it for propaganda purposes. A recent inquiry had been for the use of electricity for drying hops.

Mr. A. R. BROWNE (Woolwich Electricity Department) mentioned one or two hot water electrical installations which had shown considerable economies over other methods.

The CHAIRMAN, referring to Mr. Marryat's remarks, said the supply undertaking had several difficulties in fixing a suitable tariff, and one of them was to avoid preferential treatment. Another was that in dealing with so-called "off-peak" loads care must be taken that another peak was not being created. It might be found that the natural peak and the artificial peak would overlap.

Mr. MONKHOUSE, winding up the meeting, again pleaded for greater publicity and propaganda in connection with industrial electric heating.

Domestic Refrigeration.

An E.D.A. Conference at Newcastle.

AT a conference held under the auspices of the British Electrical Development Association at Newcastle, on January 12th, Mr. N. E. Barber read a paper on "Domestic and Small Capacity Refrigeration." Mr. H. J. Miles (president of the Electrical Contractors' Association) was in the chair.

Mr. Barber said that the main use of refrigeration was the preservation of food; it was the best preservative method because it permitted the retention of the food's natural flavour and its nutritive qualities. An effective refrigerator must possess adequate heat-insulating material; must be arranged so that the air was continually moving; and should be constructed with a view to easy cleaning. Compressed granulated cork had been found to be an efficient and convenient insulating medium. A very difficult problem was the proper fitting of the door; that had been largely overcome by the use of substantial teak frames and labyrinth seals. To facilitate the movement of air the shelves should be of an open mesh type and not solid; they should also be removable. Another feature which a refrigerator should possess was lightness and a size which would allow it to be taken through doorways easily. The author proceeded to deal with the three means of refrigeration, *viz.*, ice-thawing, mechanical and chemical. Generally speaking, the first method was not satisfactory. Mechanical refrigerators utilised condensable gases possessing a high latent heat combined with a high ratio of latent heat to specific heat, a low boiling point, a low-pressure condensing temperature, and a low ratio of

compression, while being non-corrosive, non-inflammable, and non-injurious to health. The three agents most favoured for small-capacity machines were sulphur dioxide, ethyl chloride, and methyl chloride. Refrigerating machines all operated on a common cycle, *viz.*, compression and condensation of the refrigerant and the expansion of the liquid into gas. Generally, the compressors were run at low speeds. There were several machines of the intermeshed gear type running at electric motor speeds and at least one of turbine form. It added to the efficiency to have the machines hermetically enclosed; such machines were of stationary and revolving types. The stationary forms were usually operated by a squirrel-cage motor, the rotor being within the hermetically-sealed enclosure, but in other forms the complete motor was within the sealed envelope, the necessary leads being conducted through the enclosure by a type of sparking plug. The most prominent machines on the market were of American manufacture, but European makers had produced small machines showing marked advance in design. British refrigerators were usually on orthodox lines, but two makes were hermetically enclosed. The principal difficulty in compressor design appeared to be the gland through which the operating shaft projected; some form of disk packing backed by a spring system to compensate for wear appeared to have met with success. Those glands had to be gastight under considerable pressures, and remarkable efficiency had been attained in many small machines. The electric motor had been found to be the most suitable and convenient driver, but i.c. engines had proved satisfactory. Mr. Barber proceeded to explain the working of a mechanical refrigerator and the cycle of compression, condensation and expansion. He then dealt with the control of the machine, making special reference to direct and indirect thermostatic and non-automatic control. "Service" in connection with refrigerators was an important matter. The author quoted from a report of the National Electric Light Association, which showed that for 262 machines studied 411 service calls were made in a year; of those 119 were in respect of control, 44 related to expansion valves, and 15 to compressors; 60 were "false alarms" and the rest related to routine matters. The study indicated room for improvement in design, but "service" still had to be regarded as a factor in the sale of the appliances. Non-automatic control eliminated the cause of trouble and operation could become a matter of routine. The author said that greater economy of energy was obtained with non-automatic control. He then proceeded to explain the chemical method of heat extraction, and said that recent inventions had greatly improved the system. With regard to the application of refrigeration, he said that some thousands of ice-cooled refrigerators had been supplied to retail shopkeepers in this country, but very few had been converted to mechanical operation. The new Pure Food Regulations should do much to stimulate the sale of refrigerators. In conclusion, he said that there were British-made refrigerators which would fulfil all the requirements.

A discussion followed, and Mr. Barber, in reply to questions raised, said that to protect meat against bacterial action the temperature should be below 50 deg. There were advantages in the employment of a brine tank which acted as an "accumulator of cold." He did not think that glass insulation was satisfactory, even from a display point of view. There was a lack of standardisation, and there were many ways of converting ice-cooled refrigerators to mechanical operation. Any attempt to reduce prices by using inferior and inadequate materials would be unsafe. He thought that manufacturers should get together and share the credit to enable people to purchase refrigerators. The absorption type of machine was certainly preferable to the motor-operated pattern, but at present the scale of operation was restricted. It was generally accepted that we were only at the beginning of things in refrigeration. Mr. Barber thought, however, that a demand had been created, and that anyone who spent time and money in research stood a reasonable chance of being compensated for it.

The Telephone Service.

Statistics which Reveal Progress and Development in the London Area during 1926.

A STATEMENT of the progress made in the London telephone area during 1926, prepared primarily for the London Telephone Advisory Committee, and signed by Mr. W. A. Valentine, Controller of the London Telephone Service, and Mr. R. McIlroy, superintending engineer, London Telephone District, indicates that the boundaries of the area remained unaltered during the year; it covered 750 square miles and extended from Reigate to Waltham Cross and from Tilbury to Hayes (Middlesex).

With the opening of seven new exchanges and the closing of Bank and Latchmere, the number of exchanges reached 112 (including the trunk and toll exchanges), as compared with 107 in the previous year. The number of exchange lines connected at the end of 1926 was 298,766, the net increase for the year being 28,965, or about 10.7 per cent. The demand for private wires connecting subscribers' offices (not connected to the public exchange system) continued, the total number being 15,400. The total number of telephones (exchange and private) was 519,969, the net increase being 43,156, or about 9.0 per cent.; the 500,000th London telephone was installed on July 16th, 1926, in the Press Gallery of the House of Commons.

During the year there was an increase in the number of private branch exchanges, which totalled 22,970, as compared with 21,000, of which number 97 are automatic; orders were placed for 18 new automatic installations and schemes formulated in 10 other cases. Approximately 30,000 removals were effected during 1926. The number of call offices working was 4,686, the increase being 283. There were 418 kiosks in public thoroughfares and on private sites in the London area at the end of the year, and local, toll and trunk calls may now be made and telegrams dictated from them. The new prepayment coin boxes being fitted in call offices accept different classes of coins; 2,000 of the new instruments will be in service within the next 12 months.

Development in the business areas of London has not been so great as was anticipated, but there was a marked increase in the rate of development in the suburban areas; the extraordinary building development in the outer London areas made it specially difficult to determine the anticipated growth in those areas and to provide spare plant economically in advance of the requirements. Seven new exchanges were opened, providing an increased capacity of 11,000 lines; three new ones were also provided to replace exchanges already existing, and, together with extensions to 47 existing exchanges, provided additional accommodation to the extent of 33,000 lines. Plans were approved for five new manual exchanges to replace existing equipment, and consideration was being given to schemes for a further increase in capacity of 91,000 lines. Eleven new exchange buildings were in process of construction, and sites for 29 additional ones had been obtained.

The preliminary work incidental to the conversion of the London area to automatic working was well advanced, and specifications for exchanges to accommodate more than 100,000 automatic lines had been issued; the installation of automatic equipment was in progress at the Holborn, Western, Sloane, and Bishopsgate exchanges, and some of them should be available for service during 1927. The equipment at the "Tandem" exchange (the new junction exchange) was rapidly approaching completion, and a further essential preliminary was the changing of the numbers of subscribers connected to exchanges in the automatic area to four figures. The anticipated rate of growth during the next five years would necessitate the construction of 60 automatic exchanges within 10 miles from Oxford Circus and 25 manual exchanges outside that radius, but within the London telephone area, to replace worn-out plant as well as provide for growth.

Much progress was made during the year with schemes for improving the standard of speech, which involved the provision of a large number of cables with conductors of larger gauge than that previously employed; "loading" was also extensively utilised to improve speech transmission. The total mileage of single wire provided for subscribers' lines and local junctions was 2,030,000, an increase of 225,000 miles, the greater proportion in underground cables which contain from 20 to 2,000 copper wires, are lead sheathed, and are drawn into 7,402 miles of earthenware ducts or iron pipes, an increase of 1,000 miles. The total length of pole lines in London was 5,533 miles and the length of single wire carried on them 59,250 miles; while the total length of wire increased by 225,000 miles during the year there was an actual decrease in the length of overhead wire. In addition to existing repeater stations at Fenny Stratford and Derby, others were completed at Leeds, Catterick, Newcastle, Jedburgh, Edinburgh, Gloucester, Newport, and Birmingham, and work was in progress on stations at Taunton and Tavistock. During the year communication with Germany was provided by means of repeater circuits, nearly all underground, with the exception of the submarine cable between England and Holland. Repeater stations were under construction at Marks Tey and

Halesworth in connection with the London-North Walsham route, and the Aldeburgh underground and submarine route to Holland and Germany, as well as at Canterbury in connection with the London-Canterbury cable, which will connect with submarine cables to Belgium and France. In certain cases additional trunk circuits were provided by means of the high-frequency carrier-current system, sometimes referred to as "wired wireless," thus avoiding the cost of the erection of additional wires.

The number of calls originated during 1926 was 499,473,766, an increase of about 4.9 per cent., which was not quite commensurate with the growth of subscribers, and it appeared that the average number of calls made per subscriber was decreasing. The acquisition of the telephone habit requires time for its development and the new subscriber does not, at the outset, make use of the telephone facilities at his disposal with that freedom which characterises the more experienced user. In a rapidly developing system the accession of blocks of new subscribers with low calling rates tends appreciably to depress the average calling rate over the whole system; trade depression also had an adverse effect on the calling rate. The number of calls outgoing daily from London at the Trunk exchange was 14,700, and at the Toll exchange 15,200, representing increases of 10 and 16 per cent., respectively. Traffic over the Anglo-Continental routes continued its upward tendency, and the outgoing effected calls for 1926 showed an increase of 20.2 per cent. At the end of 1926 there were 53 international circuits, of which 21 terminated in France, 8 in Belgium, 12 in Holland, and 12 in Germany. During the early part of 1926 a preliminary night service to Germany was opened with three circuits—Berlin, Hamburg, and Cologne; later, continuous service was available to Berlin and Hamburg, and to other towns reached through them. Four circuits were available to Berlin, four to Hamburg, and one each to Cologne, Frankfurt, Dusseldorf, and Bremen; Anglo-German traffic was increasing rapidly, and additional circuits to France and Belgium were nearing completion. A new French cable containing 42 pairs of wires, with the appropriate land lines, will improve the existing Anglo-French service and provide direct Swiss and Italian services. A new submarine cable laid between England and Belgium provided 21 additional circuits, and there is a possibility of obtaining circuits later to Vienna and Prague *via* this cable. Proposals are also in hand for the provision of a circuit to Stockholm. A transatlantic (London-New York) radio-telephone service was inaugurated on January 7th, 1927.

To the Phonogram exchange at the Central Telegraph Office, equipped for the reception and transmission of telegraph messages direct from and to telephone subscribers, 100 lines from local telephone exchanges were added, making a total of 480 lines; sixty-eight telephone exchanges have direct circuits to the Phonogram exchange, at which 234 operating positions are staffed during busy periods. The number of phonograms dealt with during 1926 was 1,616,784, the increase being about 13.5 per cent.

The operating staff in the exchanges within the London telephone area numbered about 9,400 telephonists and supervisors; over 1,200 new entrants passed through the Telephone Operating School during the year, and 61 telephonists employed by subscribers for the operation of their private branch exchanges were trained. Over 7,000 engineering workmen were employed in the London area.

The average time of answer to the subscribers' calling signals for the year was 5.7 seconds, and the average time from the commencement of a call until the called subscriber answered was 38.6 seconds. The difficult conditions during the period of the general strike affected the figures to some extent; also the strike resulted in increased traffic at some of the exchanges by nearly 50 per cent., the Trunk and Toll exchanges being very heavily pressed. The percentage of calls completed on first application was 82.4, which figure has remained almost unaltered for five years. The proportion of telephones to population was 1 to 14.96.

Sulphur Mines Electrification.

Sulphur is one of the few minerals that Italy possesses and exports in large quantities. Her mines in Sicily afford employment for some 18,000 persons; they are therefore of great economic importance to the island, but hitherto they have laboured under the disadvantage of antiquated equipment and working organisation. It has long been felt that the electrification of the mines is essential for their economic recovery, and now at last comes the news that a decisive step has been taken in this direction. The Corporation for the Technical and Economic Development of the Sulphur Industry has signed a contract with the General Electric Company, of Sicily, for the electrification of all the services connected with the Sicilian sulphur mines. The power will be produced by a steam-operated station at Catania, which will transmit it to all the sulphur mining districts over a main line at 40,000 volts running between Catania, Caltanisetta, and Campo-Franco, with a subsidiary line at 10,000 volts for the Caltanisetta-Sommatino district. The cost of the installation is estimated at from 34 to 35 million lire, of which the Corporation is to contribute eight millions. The total length of the lines to be installed is over 300 miles.

Electric Floodlighting.

Review of Illuminating Society Paper and Discussion.

A PAPER on the above subject was read recently by Messrs. W. J. Jones, H. Lingard and T. Catten, at the meeting of the Illuminating Engineering Society, held at the Lighting Service Bureau. Mr. C. W. Sully presided.

The paper was illustrated with numerous lantern slides and examples of apparatus, and contained an excellent review of the subject. In the introduction, reference was made to the many applications of floodlighting, for illuminating posters, lighting up monuments, and revealing the outsides of buildings. Attention was drawn to the great importance of the surfaces of buildings illuminated. White glazed brick, when clean, reflected 85 per cent. of light, very dirty stone and concrete only 5 per cent., and in this extreme case the absorption of light was practically prohibitive. The smoke-begrimed surfaces of buildings in many industrial cities presented one of the greatest obstacles to flood-lighting. With white glazed brick from 2 to 5 foot-candles illumination, according to the surroundings, might suffice; with fairly clean granite, reflecting 10-15 per cent. of light, from 13 to 33 foot-candles was specified. For ordinary posters in poorly lighted districts 5 foot-candles might be allowed, but in very brightly lighted areas 15 or even 25 foot-candles might be necessary to cause the surface to "show up" satisfactorily.

The next section of the paper dealt with the optical principles underlying floodlighting equipment. The formation of the beam by a parabolic mirror was explained and it was pointed out that at moderate distances the inverse square law applied. An interesting feature of the paper was the description of sectional mirror floodlights, the author pointing out that in this case the maximum beam candlepower depended primarily on the candlepower of the source, whereas with a polished parabolic mirror the intrinsic brightness of the filament was the determining factor. Some very interesting curves showing the distribution of candlepower in the beam were presented; they showed that with a bare lamp there were usually marked "kinks," a fact that was evident from inspection of the various floodlights on view. The curves might, however, be smoothed out by using frosted lamps, or light-diffusing cover-glasses, though they naturally diminished the maximum beam candlepower and tended to greater dispersion angles. Asymetric light-distribution, which was occasionally desirable, might also be obtained by applying specially designed "spreading glasses." Effects were also illustrated by "isolux" diagrams.

A very useful table contained particulars of the utilisation efficiencies of various types of floodlighting units. The maximum utilisation efficiency recorded was 55 per cent. with a deep parabolic plain mirror, the same value being reached with a ribbed-mirror square-pattern flood lantern; at the other extreme the efficiency of the diffusing glass front and plain mirror was only 35 per cent. Mr. Jones described the use of anti-glare shields and methods of confining the beam to the object to be lighted, and referred to the influence of "spill" light (which passed by the edge of the building, or area to be lighted, and was thus wasted). This loss was not taken into account in the coefficient of utilisation, and naturally depended on the local conditions.

In the concluding part of the paper a number of floodlighting installations were described and illustrated, and the special problems met with in each case discussed.

The paper led to an animated discussion, which was opened by Lt.-Commander Haydn T. Harrison. Mr. J. W. T. Walsh, who followed, pointed out that in several respects floodlighting units differed from searchlights and suggested 40 ft. as the minimum distance at which the inverse square law could be utilised. The suggestion was made that the use of a special front-mirror, directing back part of the light received, might have advantages in eliminating undesirable effects of direct rays from the source. Various technical points were discussed by Mr. Milner, Mr. Ritchie, and others.

Mr. L. G. Applebee demonstrated a number of projectors which had been used for stage lighting, &c., illustrating his remarks with views of the scenes in the searchlight tattoo at Wembley, &c. Others who took part in the discussion included Mr. Morton, Mr. Long, Mr. Cunnington, Capt. W. Liberty, and Mr. J. S. Dow. The chairman (Mr. Sully) joined with others in complimenting the authors on their paper, and Mr. Jones briefly replied to a number of the points raised.

Electricity on the Poultry Farm.

Poultry farmers in the Preesall district, near Blackpool, have adopted the system of utilising electric light for increasing the production of eggs. A large poultry farmer states that the fertility of the eggs used for hatching has increased 20 per cent. In October he installed electric light, and was rewarded by an increase of 60 eggs per day at a time when eggs were 3s. 2d. per dozen; he thus made an extra 15s. daily, and in a short time paid off his initial outlay of £15, and £2 cost of electricity. The light gives the hens a 16-hour day in the depths of winter, and so long as there is light they will take exercise, feed, and lay.

Reviews.

Principles of Electric Power Transmission and Distribution. By L. F. WOODRUFF. Pp. 340; 112 illustrations. London: Chapman & Hall, Ltd. Price 20s. net.

According to the preface this volume is intended primarily as a text book for senior and graduate students in electrical engineering in the American Universities and Institutes of Technology. As is so often the case with volumes of this kind, the text has been elaborated from notes used in technological courses on the subject, and quite naturally the requirements of the particular Institute with which the author is connected are reflected in the treatment of the work.

Chapter I gives a very brief survey of the general problem of electric power transmission and distribution, with special reference to the progress made in the United States. On page 8 the author is not very consistent, for he says: "the efficiency of a transmission system is not of much importance in itself," &c., while a little lower down on the same page he says: "the power losses in lines and machinery are but one item, albeit an important one, of the total annual cost." The power losses and, therefore, the efficiency of a system are distinctly important, but what the author does not make clear is that reliability should not be sacrificed in efforts to obtain what often are unduly high efficiencies.

Chapter II is merely a three-page note purporting to give an idea of the electron theory and of the general electromagnetic circuit; it is, however, so scanty as hardly to have been worth including.

The really serious part of the volume commences with Chapter III, which studies the characteristics of the electromagnetic circuit and of its natural property, inductance. This chapter presupposes an elementary knowledge of the calculus and of the symbolic method of vector notation.

Chapter IV is companion to the preceding one and deals with the dielectric circuit and its natural property, capacitance. The treatment also is similar to that of the preceding chapter.

In Chapter V the author considers the efficiency and voltage regulation of short and medium-length transmission lines, dealing first with very short single- and three-phase lines, neglecting the effect of capacitance. He then studies what would be the general effect of allowing for capacitance, and shows the two well-known methods of treatment, namely, the nominal T and the nominal π circuits.

Chapter VI is another very short chapter which could with advantage have been eliminated; it deals with the mechanical principles of overhead transmission lines. The only part in this chapter of any real interest is a short analysis of the sag and stress in an overhead line. When we consider the tremendous amount of matter that has been published dealing with the mechanics of overhead lines, it will be realised how futile it is to include just a few pages on the subject in a book of this description; moreover, it is disappointing to the student and does not tend to enhance an author's reputation.

Chapter VII deals with the all-important subject of skin effect in conductors carrying alternating currents; the author mentions first the cause of skin effect and then passes on to an elaborate study of alternating-current distribution in an isolated round wire. He then gives expressions for the skin-effect resistance ratio for round wires and also a table of skin-effect resistance and inductance ratios for solid round wires.

Chapter VIII, which is concerned with the subject of corona, opens with a general description of what the term is intended to convey and an explanation of it in terms of the electron theory.

Having in mind the increasing tendency to raise already high transmission-line pressures and the importance that insulation must of necessity play in the transmission of electrical energy, it is particularly disappointing to find this subject dismissed in Chapter IX with a mere 12 pages. In these the author indicates very briefly the latest theories of insulation breakdown, the variation of breakdown voltage with insulation thickness, the potential gradient in single-core cables, with homogeneous and multiple dielectrics, and finally the distribution of voltage stress on suspension line insulators. The whole treatment in this chapter in inadequate.

Chapter X is a study of hyperbolic solutions of long-line, steady-state problems concerning which the general considerations are first enumerated.

Chapter XI is mostly a reprint of a paper contributed by the author to the *Electrical World*, and is a very cursory survey of the subject of power-factor correction and voltage control of long lines. The comments put forward are very brief, and we cannot imagine them adding appreciably to any student's technical equipment.

Chapter XII is an anlysis of the steady-state performance of long transmission circuits and accessory apparatus. It opens with a short analysis of equivalent star (called by the author "wye") and delta connections, in which the very reprehensible practice has been adopted of writing "same numerator" and "same denominator" in an expression where the numerator or denominator is the same as in an immediately preceding expression; we think there is no excuse for such slovenly composition.

The interesting subject of inductive interference with telephone and telegraph circuits is covered by Chapter XIII.

Chapter XIV deals with the solution of the current and voltage values in a.c. networks under normal operating conditions and under fault conditions of short circuit.

In Chapter XV commences the most interesting part of the book. This deals with transients in circuits with lumped constants, and simple d.c. excited circuits are first investigated. The author then passes on to considerations of the transients in simple a.c. circuits, and after having shown the utility of Heaviside's and Carson's expansion formulæ for d.c. and a.c. transients respectively, passes on to consider the transients in circuits containing iron. For this purpose the switching-in phenomena of a static transformer are investigated in a manner similar to that already covered by Steinmetz.

Chapter XVI studies current and voltage transients on transmission lines, a preliminary solution being given by differential equations. The treatment is extended to cover mathematically and diagrammatically the transient conditions when an overhead line is short-circuited at one end, and when it is open. The reflections that occur at transition points, and the attenuation due to resistance and leakage, are investigated, and some interesting oscillograms are given of representative tests made in the laboratory on artificial lines.

The volume is concluded by three appendices, an index, and examples to be worked out, at the end of each chapter, bearing upon what has immediately preceded them.

While the work evidently meets the requirements of those for whom primarily it has been written, we think the author would be well advised to recast it in a more generous mould for a future edition, in which case we feel confident it would appeal considerably to a much wider section of the electrical engineering profession.—S. AUSTEN STIGANT.

Overhead Electrical Transmission Lines: Wade's Tables. Revised and Enlarged Edition, 1926. Hull: Richard Wade, Sons & Co., Ltd. Price 15s. net.

The production, in 1906, by Messrs. Richard Wade, Sons and Co., Ltd., of that little handbook of tables of wooden-pole strengths which has been the standard of reference on the subject ever since, was, at the time, regarded as an achievement, and the engineer in this country who is not familiar with "Wade's Tables" has certainly not been in touch with overhead-line construction. New requirements, new ideas, and new legal regulations have come into being since then, and, although the basic facts still remain unchanged, they are now differently applied. The new "Wade's Tables" give not only the old information in a form suited to the altered requirements, but also include a great deal of supplementary information, and the authors are to be complimented on their compilation.

One of the first things to be determined in designing an overhead line is the size of pole. This is so bound up with the span and the sag of the conductor that one cannot be decided without a knowledge of the others. The new edition of the tables provides all three: it gives them in a useful and concise form; it gives full details of the methods by which the figures have been calculated, and states clearly the physical constants and values on which they are based—a most important point and one that is frequently overlooked.

The choice of sizes of solid and stranded conductors displays a tendency to cling to the old standards rather than the new ones of the B.E.S.A., but the range covered is in line with present practice, and has wisely been extended at both ends to beyond the normal requirements. It is rather a pity that the B.E.S.A. standards of tensile strength were not adopted in drawing up the sag-tension tables instead of the minimum allowed by the Electricity Commissioners, as considerably smaller sags are thereby obtainable. The sags given for 22 deg. F. with ice and wind loading, it should be noted, are not vertical sags. The vertical sag with ice and without wind, which is what is required for determining ground clearance at 22 deg. F., is appreciably less than the figures given for the longer and more usual spans of medium-sized conductors.

The values given for both sags and tensions are well within the attainable limits, and are consequently useful and safe figures for the mains engineer, but not for the competitive contractor. The table on page 64, showing the deflection of poles under load, is both interesting and useful. Too often is the capability of a pole to withstand a given load with safety taken as a final indication of its suitability without any consideration of what the pole will look like when loaded! A table of pole weights and cubic capacities would enhance the value of the book in the eyes of the erecting engineer and would form a desirable addition to future editions. The notes and illustrations on foundations of Rutter and A-type poles are quite in order, but would have been more complete had the comparison been extended to Anchora and other types of poles with improved foundations.

Perhaps it is not too much to hope that Messrs. Wade will be able in the next revision to amplify their excellent tables by coupling the correct sinking depth and area of kicking baulk (or other details of substructure) with each size of pole, so that the most economical use of the materials may be obvious at a glance. In the meantime every line engineer will find the present edition well worthy of a place on his bookshelf.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

18,468. "Variable electric condensers." Dubilier Condenser Co. (1925), Ltd. July 19th, 1924. (237,286.)
20,702. "Magnetic materials." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). August 18th, 1925. (263,207.)
20,974. "Two-pin electrical plugs." H. Rottenburg and H. B. Bartholomew. August 21st, 1925. (263,208.)
21,680. "Fusible electric cut-outs." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. August 22nd, 1925. (263,209.)
21,227. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 25th, 1925. (263,210.)
21,483. "Telephone instrument circuits." Siemens Bros. & Co., Ltd., and G. F. Dutton. August 27th, 1925. (263,211.)
23,612. "Apparatus for compensating or regulating the power factor of asynchronous dynamo-electric machines." J. L. Matabon and C. M. Foucault. September 20th, 1924. (240,158.)
23,386. "Testing thermionic valves, lamp bulbs, and the like." C. J. Sutton. September 19th, 1925. (263,218.)
23,791. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 23rd, 1925. (263,226.)
23,802. "Electric fuses." Brighton Lighting and Electrical Engineering Co., Ltd., and E. Heaps. September 24th, 1925. (263,233.)
23,955. "Electric condensers." British Thomson-Houston Co., Ltd., C. J. Morton, and L. Griffiths. September 25th, 1925. (263,236.)
25,090. "Means for cutting out a faulty line section in an electrical distribution system." F. J. Nankivell. October 8th, 1925. (263,247.)
25,513. "Water- and gas-tight electric switches." J. P. Annacker. October 13th, 1925. (263,251.)
25,924. "Electric cooking stoves and the like." Jackson Electric Stove Co., Ltd., and F. Smith. October 16th, 1925. (263,254.)
26,304. "Apparatus for receiving wireless signals." A. Barringer and Ormsby & Co., Ltd. October 20th, 1925. (263,258.)
26,368. "Electric inductance and transformer coils." E. L. Wildy and London Electric Wire Co. & Smiths, Ltd. October 21st, 1925. (263,259.)
30,432. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. C. Puckette. December 2nd, 1925. (263,289.)
30,979. "Ignition magnetos for internal-combustion engines." British Lighting & Ignition Co., Ltd., and J. C. Hutton. December 8th, 1925. (263,286.)
31,323. "Terminal connecting devices for high-tension cables." British Lighting & Ignition Co., Ltd., and J. C. Hutton. December 11th, 1925. (263,291.)
31,729. "Hand-tool for adjusting and cleaning the sparking terminals of ignition plugs for internal combustion engines." W. D. L. Busby. December 16th, 1925. (263,294.)
32,191. "Condenser telephones." P. G. A. H. Voigt. December 21st, 1925. (263,300.)

16,094. "Electromagnetic apparatus for recording sound and record produced thereby." A. F. Sykes. June 22nd, 1925. (Cognate applications 21,011/25 and 10,645/26.) (Addition to 210,956.) (263,502.)
21,339. "Electrical resistance units." American Resistor Corporation. August 29th, 1924. (239,216.)
21,430. "Process for the cooling of internal-combustion engines and electric transformers." T. Popescu, A. Pais, and C. Pais. August 26th, 1925. (263,511.)
22,129. "Automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. September 4th, 1925. (263,514.)
23,857. "Acoustic horns." Standard Telephones and Cables, Ltd. December 31st, 1924. (245,415.)
24,154. "Fine-adjusting devices for radio and like instruments having a rotary part." Igranic Electric Co., Ltd., and A. H. Curtis. September 28th, 1925. (263,531.)
24,258. "Alternating-current commutator machines." Siemens-Schuckertwerke Ges. October 4th, 1924. (240,831.)
24,402. "Protective arrangement for electrical machinery." T. W. Ross and Metropolitan-Vickers Electrical Co., Ltd. September 30th, 1925. (263,544.)
24,411. "Means and method for controlling or preventing oscillations in vacuum tube circuits." R. E. Thompson Manufacturing Co. October 13th, 1924. (241,185.)
24,542. "Recording of sound." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). October 1st, 1925. (263,550.)
24,629. "Submarine cable core and insulation therefor." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). October 2nd, 1925. (263,553.)
24,630. "Inductance coils." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). October 2nd, 1925. (263,554.)
24,842. "Wireless circuits." M. A. Robinson. October 6th, 1925. (263,560.)
24,905. "Apparatus for compensating or regulating the power factor of dynamo-electric machines." J. L. Matabon and C. M. Foucault. December 24th, 1924. (Addition to 240,158.) (245,067.)
25,360. "Circuit-breakers, current-limiters, and the like for electric wiring installations and supply distribution systems." M. S. Hoban. October 12th, 1925. (263,565.)
25,532. "Operating mechanism for wireless apparatus." C. Holt. October 13th, 1925. (263,567.)
25,580. "Apparatus for compensating or regulating the power factor for asynchronous dynamo-electric machines." J. L. Matabon and C. M. Foucault. February 17th, 1925. (Addition to 240,158.) (247,913.)
25,624. "Electrical wiring systems." W. Shaw and G. Heptonstall. October 14th, 1925. (263,568.)
26,467. "Dynamo-electric machines with series excitation." Maschinenfabrik Esslingen. October 23rd, 1924. (241,924.)
26,662. "Filtering arrangement for direct current." Dubilier Condenser Co. (1925), Ltd. October 24th, 1924. (241,944.)
27,504. "Electro-magnetic apparatus for collecting electric currents from space." J. E. Christofleau. December 19th, 1924. (244,723.)
27,561. "Process for making electric batteries." Dr. F. Melms. November 6th, 1925. (263,587.)
29,713. "Electrically-driven lawn-mowers." H. Watson & Sons, Ltd., and E. Watson. November 24th, 1925. (263,597.)
29,895. "Electric circuit-protecting devices." English Electric Co., Ltd., and R. A. R. Bolton. November 26th, 1925. (263,598.)
29,945. "Electric vacuum cleaners." H. Ascher. December 3rd, 1924. (244,684.)
30,987. "Interrupting devices for electric circuits." British Lighting and Ignition Co., Ltd., and J. C. Hutton. December 8th, 1925. (263,609.)
31,735. "Single-phase induction regulators." Switchgear & Cowans, Ltd., G. H. Nerp, and D. Firth. December 16th, 1925. (263,615.)
31,760. "Protection of rotary convertors." English Electric Co., Ltd., and R. A. R. Bolton. December 16th, 1925. (Addition to 237,730.) (263,616.)

1926.

1,293. "Electric solenoids." S. L. Glenn and E. E. Pierce. January 16th, 1926. (263,315.)
2,996. "Motor driven electric current rectifiers." H. Gottschlich. February 2nd, 1926. (263,326.)
6,978. "Apparatus for the electrification of gases." C. H. Shearman. March 13th, 1926. (263,356.)
9,107. "Cooking stoves with thermo-electric storage." S. Sacerdote. April 6th, 1926. (263,365.)
10,401. "Electric batteries." M. Turnauer. April 20th, 1926. (263,374.)
11,386. "Electromagnetic sound-reproducing apparatus." Brandes Laboratories, Inc. February 16th, 1926. (263,382.)
14,023. "Electricity meters." P. R. Kuehnrich. June 3rd, 1926. (263,399.)
15,513. "Tungsten arc lamp." General Electric Co., Ltd. February 3rd, 1926. (263,405.)
15,900. "Electric motor controllers." R. H. Barbour and J. R. Walton. June 24th, 1926. (263,408.)
17,458. "Diaphragms." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). September 22nd, 1925. (Divided application on 23,664/25.) (263,411.)
17,712. "Electric batteries of the flash-lamp and similar type." T. Winston. July 15th, 1926. (263,413.)
18,000. "Electrical socket connectors." J. W. Barber and Brownie Wireless Co. July 19th, 1926. (263,415.)
20,865. "Combined altimeter and tel-meter." Soc. d'Optique et de Mécanique de Haute Précision. January 26th, 1926. (263,437.)
21,937. "Combined electric table lamp and alarm clock." F. Halstrup. April 26th, 1926. (263,447.)
26,679. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 25th, 1925. (Divided application on 263,210.) (263,467.)
30,775. "Magnetic materials." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). August 18th, 1925. (Divided application on 263,207.) (263,476.)

1,166. "Electrical resistance devices." Igranic Electric Co., Ltd., and J. H. Abbink-Spaink. January 15th, 1926. (263,634.)
4,095. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. February 12th, 1925. (247,593.)
4,756. "Adjustment of vehicle searchlights." R. Bosch Akt. Ges. March 16th, 1925. (249,090.)
5,725. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. February 28th, 1925. (248,308.)
6,798. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. March 11th, 1925. (249,132.)
6,805. "Electric motors." British Thomson-Houston Co., Ltd. March 11th, 1925. (249,134.)
6,917. "Contact body for crystal detectors." S. Berglund. March 12th, 1926. (Convention date not granted.) (249,145.)
7,178. "Thermionic valve amplifier circuits." W-K Electric Co. May 13th, 1925. (252,128.)
7,204. "Junction box or pull-box for electric wiring." D. Houtman, jun. March 14th, 1925. (249,165.)
7,320. "Electric transformers." A. B. Cooper. March 21st, 1925. 249,524.)
7,649. "Electric elevator systems." Waygood-Otis, Ltd. May 21st, 1925. (252,329.)
7,852. "Loud speakers or earphones for wireless reception and other applications." Soc. Anon. des Brevets Kornfeld. March 23rd, 1925. (Patent of addition not granted.) (249,558.)
8,863. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. April 25th, 1925. (251,252.)
9,703. "Electrical water-heaters." H. W. Woodgate and F. W. Slade. April 13th, 1926. (263,664.)
10,222. "Earthing bush attachment for electric conduits." J. C. Davidson. May 1st, 1925. (251,610.)
10,619. "Rotary sparking devices for converting three-phase supply currents into high-frequency energy for induction furnaces." G. M. Ribaud. May 13th, 1925. (252,138.)
10,869. "Radio receiving system." Hazeltine Corporation. May 26th, 1925. (252,691.)
11,801. "Differential frequency relays." British Thomson-Houston Co., Ltd. May 6th, 1925. (251,904.)
11,809. "Automatic regulator systems for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. May 11th, 1925. (251,905.)
11,870. "Electric current-converting systems." British Thomson-Houston Co., Ltd. May 9th, 1925. (252,003.)
11,920. "Electrically-illuminated signs and display apparatus for advertising and other purposes." F. Biggin and G. H. Biggin. May 7th, 1926. (263,667.)
12,172. "Method of transmitting electric charges through a gaseous medium." L. Levy. May 14th, 1925. (252,167.)
13,265. "Machine for electric welding, soldering, or the like." J. E. J. Languepin. May 23rd, 1925. (252,411.)
13,842. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. June 1st, 1925. (252,746.)
13,848. "Electric switches and systems of motor control employing the same." British Thomson Houston Co., Ltd. June 1st, 1925. (252,748.)
15,595. "Thermo-electric generators." British Thomson-Houston Co., Ltd. June 22nd, 1925. (Addition to 250,188.) (253,942.)
16,582. "Tautening devices for stretched filaments in electric lamps and discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 2nd, 1925. (254,733.)
17,002. "High-tension electric cables." Pirelli & Co. September 1st, 1925. (257,894.)
19,810. "Method of and means for insulating high-tension members in electrical gas-purifying apparatus." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges. Akt.-Ges.). August 11th, 1926. (263,698.)
20,750. "Electrical signalling and controlling systems." Metropolitan-Vickers Electrical Co., Ltd. August 28th, 1925. (257,606.)
21,581. "Securing device for the terminal box of electricity meters." Landis & Gyr Soc. Anon. November 21st, 1925. (261,710.)
21,582. "Application of a permanent brake to electricity meters." Landis and Gyr Soc. Anon. November 17th, 1925. (261,711.)
21,737. "Lightning arresters." British Thomson-Houston Co., Ltd. September 14th, 1925. (258,253.)
22,541. "Transformers." British Thomson Houston Co., Ltd. September 11th, 1925. (258,287.)
22,622. "Sockets for Pupin coils in marine cables." Siemens-Schuckertwerke Ges. September 15th, 1925. (258,564.)
22,623. "Sockets for Pupin coils in marine cables." Siemens-Schuckertwerke Ges. September 15th, 1925. (258,585.)
22,737. "Electric power amplifiers." British Thomson-Houston Co., Ltd. October 1st, 1925 (259,197.)
25,191. "Electric heating devices." Metropolitan-Vickers Electrical Co., Ltd. October 10th, 1925. (259,610.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 26th :—

Tubolume. No. 474,851. Class 6. Illuminated electric signs.—Gesellschaft fur Elektrische Industrie, Berlin. (British representatives: Cruikshank and Fairweather, 65-66, Chancery Lane, W.C.2.)

Octron (lettering and design). No 475,561. All goods in Class 6. No. 475,562. All goods in Class 8. No. 475,564. Class 13. Electric alarms (as systems in buildings) and complete electric lighting sets for vehicles.—H. S. Electric, Ltd., 32, Charlotte Street, Birmingham.

Monosonic. No. 473,065. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Anglo-American Chemical Co., Ltd., 114-115, Saffron Hill, E.C.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

AYR.—Housing scheme (4th section, 68), Woodfield; burgh surveyor.

AYRSHIRE.—Hall at St. Ninian's Episcopal Church (£3,200); the rector.

BARDNEY (LINCS.).—Sugar beet factory, for Lincs. Beet Sugar Co.; Sir Robt. McAlpine & Sons, builders.

BATH.—Additional 140 houses, Southdown, for the T.C.; borough surveyor.

BERKHAMSTEAD (HERTS.).—Additional housing scheme (56), for the T.C.; borough surveyor. Bank, High Street, for the Westminster Bank, Ltd.

BIRMINGHAM.—Branch municipal bank at Stratford Road; H. H. Humphries, Hall Green, city engineer.

BRIGHTON.—Reconstruction, 5 & 6, Manchester Street, and 5, Steine Street; Southdown Motor Services, Ltd. Alteration, Theatre Royal, New Road; Theatre Royal Co., Ltd. Development of Patcham Place, including Pavilion; borough engineer. Extensions, New Sussex Hospital (£10,000); the secretary.

BRISTOL.—Housing scheme (174), for the T.C.; L. S. McKenzie, city engineer.

CARLISLE.—Houses (50), for the T.C.; J. & R. Bell, builders.

CATERHAM.—Machinery and plant (£40,000), mental hospital, for the Metropolitan Asylums Board.

CHICHESTER.—Secondary school for boys (£15,000), for West Sussex E.C.; director of education, Chichester. Enlargement, Royal West Sussex Hospital; governors.

COLYTON.—Grammar school; Devon County architect.

CROYDON.—110 houses, Chipstead Avenue, &c.; F. H. Willcocks, Beechwood Avenue.

DOVER.—Harbour buildings; Harbour Board. Harbour improvement scheme; Southern Railway and Dover Corporation.

EDINBURGH.—Department of Zoology at University (£80,000); Sir Robert Lorimer, architect.

ELTON.—Schools (£9,000), for Cheshire E.C.; J. G. Davies and Sons, builders, Frodsham.

EXETER.—Library; J. Bennett, city architect.

FALKIRK.—276 houses for Corporation (£100,000); burgh surveyor.

FINEDON (NORTHANTS).—Factory, Irthlingborough Road, for the Highfield Boot Co., Ltd.

FIRBECK (DONCASTER).—Housing scheme (1,000), for the Firbeck Colliery Co.

GLASGOW.—Additions to Royal Infirmary (£25,000); medical superintendent. Nursing home at Merryflatts (£25,000); clerk, Govan Combination Parish Council. Works and alterations at Mauldslie Street, Partick, for Scottish Farmers' Dairy Co. (Glasgow), Ltd., 2, Anderson Street, Kinning Park; the manager. Alterations and additions to College Buildings at 83, Buccleuch Street, for Glasgow Veterinary College; the principal. Warehouse and offices at Elliot Street, for Broughton Copper Co., Ltd.; the manager.

GLOUCESTER.—Police station at Almondsbury, for the Gloucestershire County Council; E. S. Sinnott, county surveyor.

GUILDFORD.—Electrical installation, new premises, Worplesdon Road; Mason & Toogood.

GRANGEMOUTH.—Additions for Scottish Dyes, Ltd. £18,500), also water condensation machinery (£4,000); the manager.

GREAT CROSBY.—50 houses; U.D.C. surveyor.

HAMILTON.—222 houses for Corporation; burgh surveyor.

HARROGATE.—Administrative block and sick wards at Primitive Methodist Orphanage, Pannal Ash Road; J. Houfe, architect, Albert Chambers.

HASTINGS.—Pavilion; S. Little, borough engineer.

HAWARDEN.—Housing scheme (68), for the R.D.C.; F. Barrett, surveyor, Wold House.

HOLMFIRTH (YORKS).—Housing scheme (61), for the U.D.C.; surveyor.

HUDDERSFIELD.—Distributing centre, with electrical work, for the Co-operative Society; J. Berry & Sons, architects, 5, Market Place.

HULL.—Extension of Cottingham Infectious Diseases Hospital (£11,370); city architect, Guildhall.

IRISH FREE STATE (DUBLIN).—Child welfare centre, Lord Edward Street (£25,000); J. Beckett, Ltd., builders.

(THURLES).—Improvements at the County Home (£11,479); Fogarty & Dwyer.

LEEDS.—University buildings (£500,000); Lanchester, Lucas and Lodge, architects, London.

LONDON (HACKNEY, E.).—3-storey factory, Theydon Road; Merrington Bros., Ltd.

(ALDWYCH, W.C.).—Proposed four new theatres, restaurant, offices, &c., Aldwych improvement scheme (£1,500,000); C. Gulliver, London Theatres of Varieties, Ltd.

(WEST HAM, E.).—Remodelling school (£11,333), and extensions to other schools, with central heating (£9,000), for the Borough E.C.; the clerk.

(EDMONTON, N.).—Enlargement Lattymer School (£67,000); H. Knight & Sons, for Middlesex Education Committee.

(ISLINGTON, N.).—Bank, City Road, for Westminster Bank, Ltd.; H. Cheston & Son, architects.

(KENSAL RISE, N.W.).—Alteration and additions, Pavilion Cinema, Chamberlayne Road; Acme Picture Palace Co., Ltd.

(S.E.1).—Partial reconstruction of the "Old Vic" Theatre, Waterloo Bridge Road (£15,000); the manager.

(BALHAM, S.W.).—Premises for Royal Arsenal Co-operative Society, Hebdon Road and Upper Tooting Road; S. W. Ackroyd.

(BRIXTON, S.W.).—Kinema and dance hall, Brixton Road; E. A. Stone, architect.

LOWESTOFT.—Pavilion and bathing châlets; borough engineer.

MARCH.—Railway developments, including goods marshalling yard, electrically operated, for the London and North-Eastern Railway Co. (£300,000).

MERTHYR.—Extension, General Hospital; governors.

NEWMARKET.—Hospital extensions; Joint Hospital Board.

READING.—Bank for Lloyd's Bank, Ltd.; J. P. Briggs, F.R.I.B.A.

RETFORD.—Cinema, for Retford Cinema & Motors, Ltd.; Sydney Neve, secretary, Gwydyr Chambers, 140, Holborn, London.

ST. HELENS (LANCS.).—Additional housing scheme (48). Clock Face site, for the T.C.; A. W. Bradley, borough engineer.

ST. NEOTS.—Secondary schools, for Hunts. E.C.; director of education, Shire Hall, Huntingdon.

SHIPLEY.—Electricity supply, Canal Ironworks; J. Parkinson & Sons, Ltd.

SLOUGH.—Bazaar premises, High Street, for F. W. Woolworth & Co., Ltd., Kingsway, London. Shops, Alpha Street, for S. R. Bloxsome. Factory extensions, Wexham Road, for Naylor Bros.

SOUTH AFRICA (CAPE TOWN).—Grain silos, Canterbury Street; Daniel Mills & Sons. Factory, Rhodes Drive; Lamson Paragon (South Africa), Ltd. Soap and chemical factory, Chapel Street; A. H. Gatz.

SOUTHAMPTON.—150 houses on various sites; borough engineer.

STALYBRIDGE.—Houses (64), for the T.C.; Thomas Warrington, builder.

STOCKTON-ON-TEES. — Secondary schools, for Durham E.C.; director of education, Shire Hall, Durham.

STRATFORD-ON-AVON.—Proposed Shakespeare memorial theatre.

SUNDERLAND.—Alterations and additions to the Technical College, for the Education Committee; G. T. Brown and Sons, architects, 51, Fawcett Street.

SUTTON.—County school for boys; Surrey Education Committee.

SWANSEA.—46 houses, Cocket Road and Corse Road; S. Davies.

SWINTON.—Housing scheme (182), Folly Lane; H. Entwistle, engineer and surveyor, Council Offices.

THORNABY-ON-TEES.—Central schools (£15,700), for North Riding E.C.; director of education, Northallerton.

TWICKENHAM.—Secondary schools (£40,677), for Middlesex E.C.; J. Lovell & Son, builders, Gerrards Cross, Bucks.

TYNEMOUTH.—Quay shed (£7,000); borough engineer.

WARSOP.—Houses (107), Church Warsop Estate, for the Housing and Town Planning Trust.

WEMBLEY.—50 houses, Christchurch Estate; U.D.C. surveyor.

WETHERBY.—School (£10,000), for West Riding E.C.; director of education, County Hall, Wakefield.

WIGTON.—School (£6,100), for Cumberland E.C.; director of education, Carlisle.